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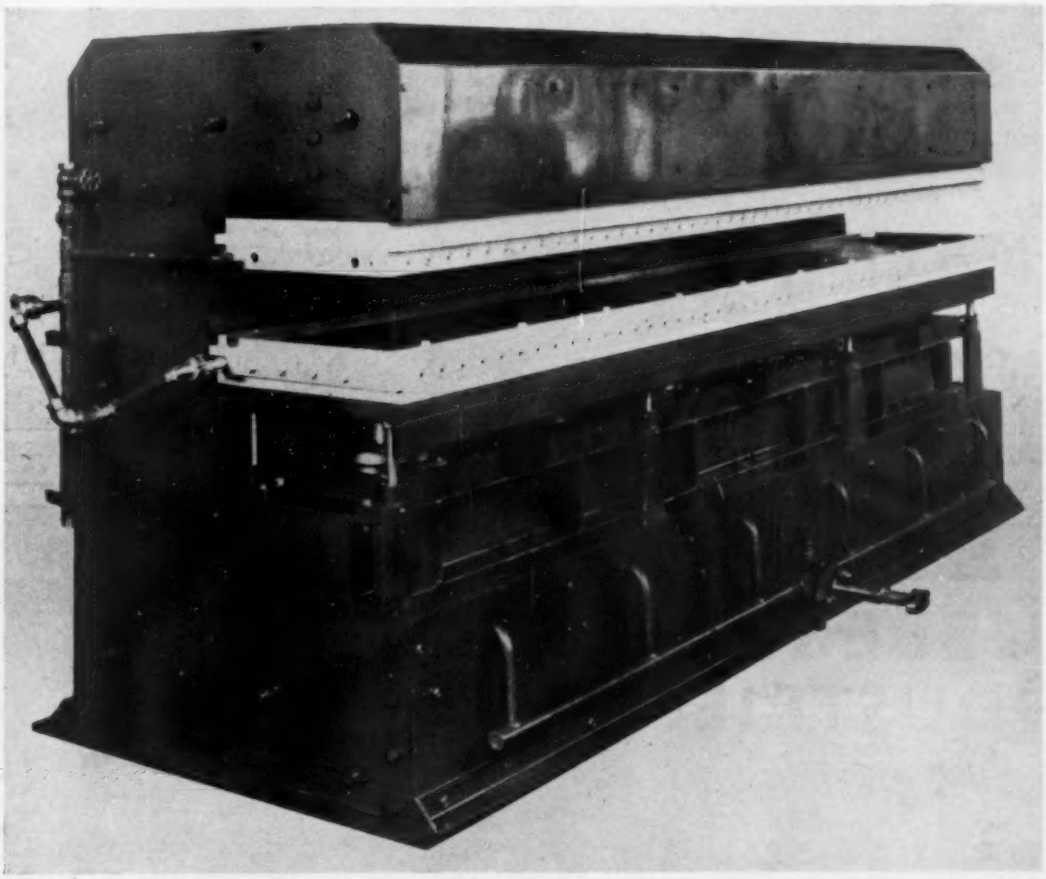

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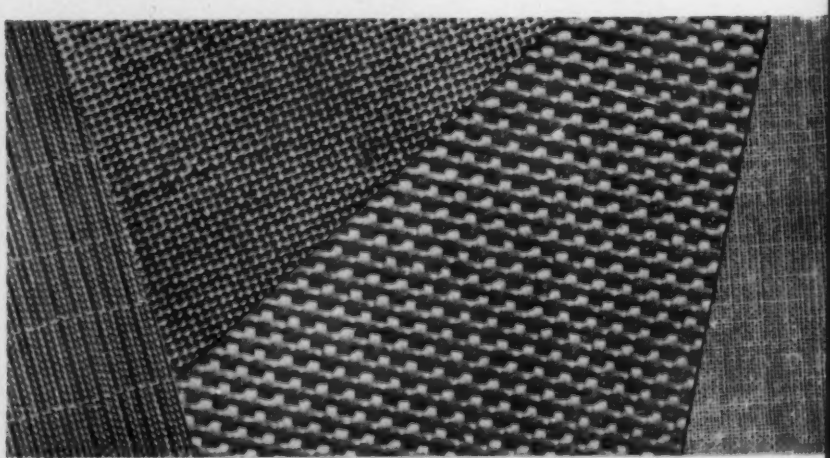

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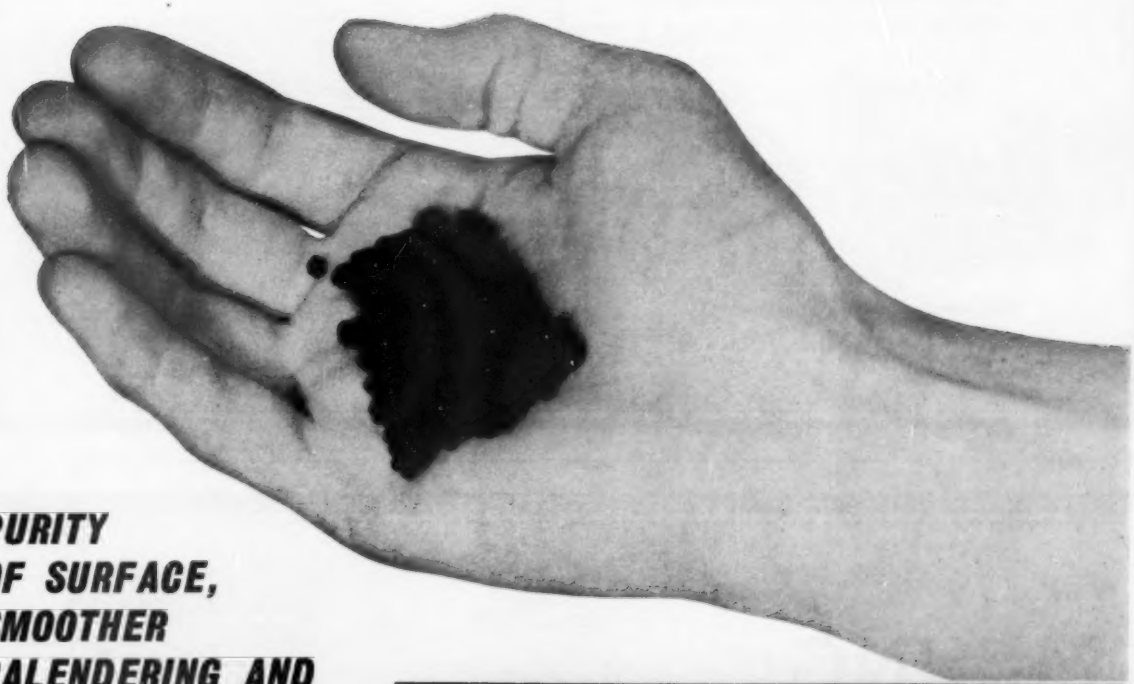

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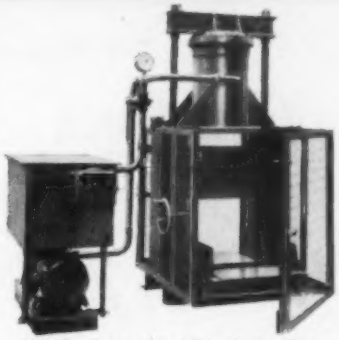
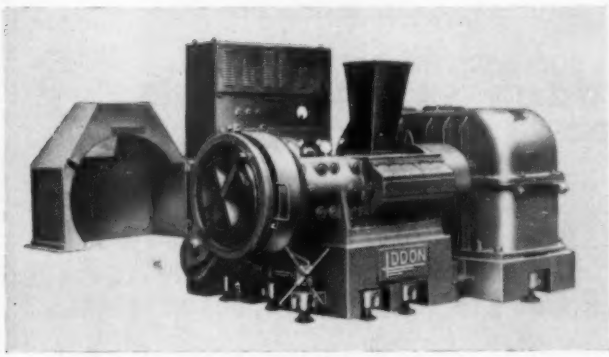
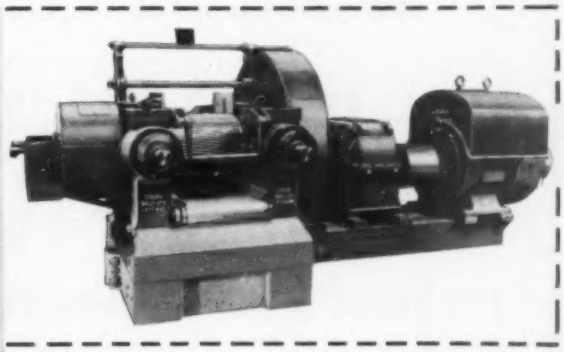


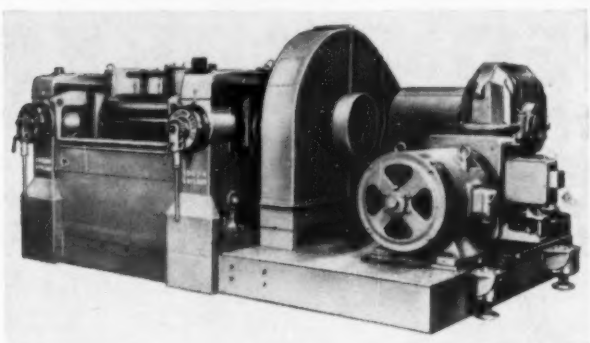
C.C.10.—Self-contained Bale Cutting Press and Pump with bale feeding attachment.



C.A.9.—Heavy duty Straining Machine, driven through double helical gear unit. Bayonet type locking head fitted with motor driven rotary cutter knife. Complete machine mounted on vibro-insulators.

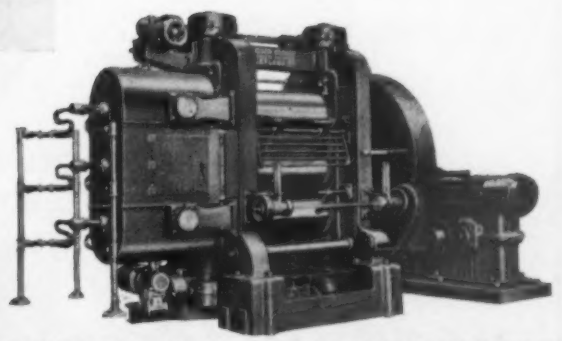


C.A.6.—Heavy duty single geared Cracker with take-off conveyor. Machine mounted on fabricated sub-frame fitted with vibro-insulators. Rolls 20in. dia.



B.Y.11.—Heavy duty single geared Mixing Mill with backshaft drive. Mounted on fabricated steel bedplate fitted with vibro-insulators. Rolls 22in. dia.

B.J.6.—Heavy duty 3-roll Calender with even and friction speeds and electrically operated roll adjusting gear. Rolls 20in. by 40in. face.



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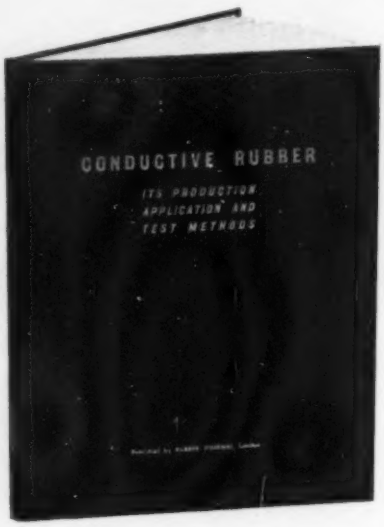

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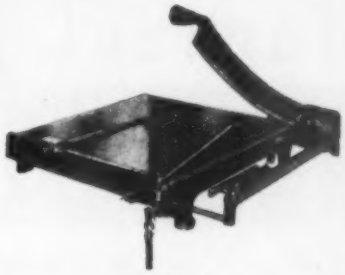

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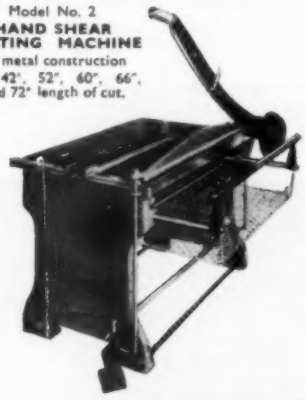

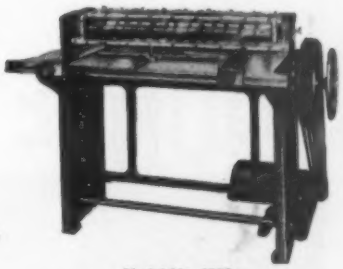

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IN ITS 76th YEAR

April 9 1960

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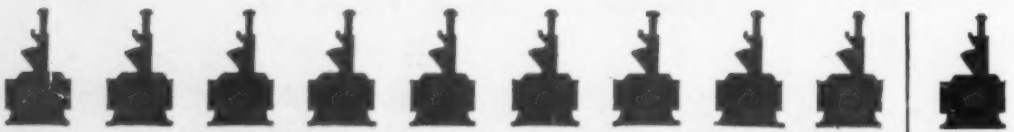

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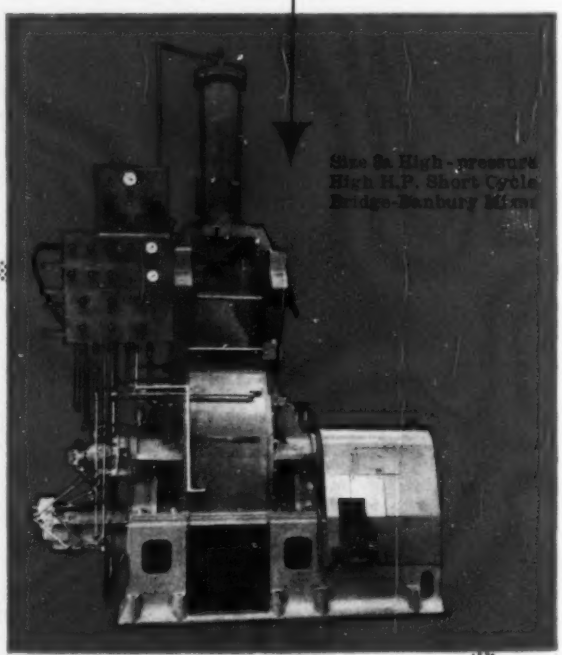

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NOTES of the WEEK

Starting Point

IF the starting point of a commercial product is an idea, then the next step is, more often than not, research. The importance of science in industry needs no stressing and was well illustrated by the record number of delegates—more than 500 of them—who attended Polymeric Progress, last week's highly successful scientific congress sponsored by the Plastics Institute.

The conference, which had members attending from all over the world, from both East and West, naturally led to some comparisons being made between our scientists and those of other countries. There is no doubt about the quality, but what about the quantity ? Here we fall behind badly. Proportionally, we have fewer scientists and technologists than Russia or America and fewer facilities for training more of them.

This position was belatedly recognized a short time ago when the position of a Minister of Science was created. Lord Hailsham has been comparatively quiet since his appointment. Perhaps he realizes how much there is to be done: and one of the things that has to be changed is an attitude of mind. For example, only this week the Ministry of Labour announced that their 'choice of career' booklets series, issued by the central youth employment executive, had reached a 'notable landmark'. The 100th in the series had been published. Its title ? 'The Scientist'. This is certainly a first-class booklet. But why have we had to wait so long for it ?

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The important part that warehousing plays is perhaps not always recognized by those who are not directly concerned with it. Manufacturers demands after the second world war for latex, for example, could hardly have been satisfied without solving problems of handling and storage. Henry Diaper did in fact carry out research on this, and were the first firm in the country to erect an installation for the bulk storage of latex. More recently the firm has carried out research into the storage and handling of synthetic latex.

We know that everyone connected with rubber will wish to congratulate the firm on its centenary—and hope that its liveliness will continue into its second century.

A New Era

THIS—'A New Era'—is the title given to the introduction of the eleventh annual report of the National College of Rubber Technology. The declaration of trust made by Herbert Rogers, chairman of the board of governors in 1949 laid down that the principal object of the college was to be: 'The provision of facilities for technical education and research in connection with the rubber industry. There may be added from time to time as occasion requires subsidiary objects of the College comprising technical education and research in other subjects approved by the Minister as suitable for inclusion in the curriculum'.

Looking back on this, we can see how neatly and closely this short statement defined the functions of the college—while leaving room for developments that are only now being realized.

Bleep Bleep

THE London Stock Exchange has recently undertaken a small scale experiment with a radio communication system. The object is to speed up the calling of Stock Exchange members from the floor of the House. The apparatus, which is pocket size, consists of a small receiver which receives a signal described as a 'Bleep bleep' from a central transmitter, and emits this audibly. It is understood that the range over which the signal can be transmitted will cover some of the immediately surrounding streets. The system, by Multitone Electrics, is the same as that operated in hospitals, to call doctors urgently, and in large factory and office blocks.

Although the system can operate up to some 1,200 frequencies, it seems not impossible that considerable confusion could arise if it becomes really widely adopted. This could especially be so where names coincide. One can imagine taxi drivers rushing into operating theatres, doctors on urgent trips being diverted into the Stock Exchange, and Stock Exchange members being told to pick up an urgent fare outside the Bank. This may also lead to some odd results being quoted on the Exchange, such as the taxi fare from the Savoy to Throgmorton Street (although, come to think of it, this already seems to suffer a daily fluctuation). We may even have a quotation for Bleep, Bleep and Co. Ltd.

NEWS *Briefs*

POLYMER RESEARCH GRANTS — MORE MARLEX RESINS — CEYLON'S PRODUCTION GOES DOWN GEON RANGE IN AUSTRALIA—CZECH SBR PLAN

●**United Kingdom**—61,181 tons of rubber remained available for sale from the Board of Trade stockpile on April 1. Sales from the Board of Trade's stock of natural rubber in March totalled 5,917 tons.

●**Canada** — Shipments of vinyl-asbestos floor tile rose to 4,442,313 sq. ft. in Canada in February from 3,537,260 in the corresponding month last year. January-February shipments of vinyl - asbestos were 8,898,215 sq. ft. (7,279,615 in 1959).

●**Australia** — B. F. Goodrich–CSR Chemicals Proprietary has been registered in Melbourne with a nominal capital of £A2m. It was formed by the B. F. Goodrich Chemical Company of the US and CSR Chemicals Proprietary to make Geon range of chemicals.

●**United States**—Expansion of its plastics activities to include the marketing of medium and low density Marlex polythene resins has been announced by T. L. Cubbage, vice-president, Phillips Chemical Company, Bartlesville, Oklahoma, USA. The resins, 14 of which will be initially available, will be made from ethylene produced by Phillips and converted to polythene for Phillips at the National Distillers and Chemical Corporation plant at Houston, Texas.

●**United States**—Allied Chemical, it is reported, intend to raise formaldehyde production at their South Point, Ohio, plant to about 280m. lb. a year.

●**Czechoslovakia**—Details given in the third five-year plan show that an SBR plant is due to be completed at Kralupy in 1963. The plan covers the period 1961-1965, and official announcements say that chemical production is to be increased by over 100%.

●**Israel**—Autocar of Haifa, which manufactures vans with polyester glass/fibre bodies is shipping the first units of an order for 600 to the USA.

●**United States**—Three British universities will share in 1960 research grants totalling $120,000, announce the US Rubber Research Centre. The three are the University of Glasgow, the University of North Staffordshire and Imperial College, London. Research includes 'basic studies of the mechanisms of creation and ageing of new fibres, plastics and types of rubber.'

●**Ceylon**—Rubber production fell to about 205 million lb. in 1959 from 224 million lb. in 1958, according to the annual report of the Bank of Ceylon. The decline is attributed to the severe drought which prevailed during the first quarter of the year.

●**Holland** — N. V. Rubberfabriek Vredestien has established a subsidiary in Paris. The company, Holland's biggest manufacturer of tyres and rubber flooring, has built up a growing market in France for its products. The subsidiary will be called S. A. Vredestien, France.

●**United States**—About 36,500 tons of deteriorating natural rubber is to be sold by the General Services Administration from the stockpile by the end of June this year. This is in addition to the tonnage already authorized for sale.

●**United Kingdom** — Exports of rubber manufactures amounted to £3,561,000 for January - February 1960. Rubber imports for the same period were valued at £5,925,000.

●**Holland** — The new carbon black plant being constructed near Rotterdam by Columbian Carbon, in conjunction with Continental carbon, will start producing in May. It is disclosed that the total investment is about $3.5m.

●**United States**—Preparations for the commercial production of two synthetics, Ameripol SN rubber (poly-isoprene) and Ameripol CB rubber (*cis*-poly-butadiene), are announced by Goodrich-Gulf Chemicals. These will be produced interchangeably in the same plant which will have an annual capacity of approximately 25,000 tons. Testing and evaluation samples are available immediately. The new rubbers will be marketed in the UK by Durham Raw Materials Ltd. (See page 533.)

●**United Kingdom** — The Board of Trade gave notice on April 7 that they are considering an application for the removal of the import duty on synthetic methanol falling under tariff heading 29.04 (c).

'What's remarkable about it — it gives the poorest yield on the estate!'— 479

New US Polydienes for UK

Goodrich-Gulf Chemicals of Cleveland, Ohio, is to start commercial production of two new polydiene rubbers which will be marketed in the UK by Durham Raw Materials.

The rubbers will be interchangeably produced in the same plant, and will be called Ameripol SN (polyisoprene) and Ameripol CB (*cis*-polybutadiene). The plant will have an annual capacity of about 25,000 tons.

Polybutadiene has excellent characteristics for minimizing heat build-up and is said to have a higher re-bound characteristic than natural. The company states that road tests of tyres containing 25-90% of Ameripol CB indicate improved treadwear and softer and quieter riding characteristics.

Initial use of both new rubbers will be in tyres for trucks, heavy construction equipment and aircraft, where they will reduce natural rubber content by, it is claimed, 50-100%.

The principal raw material for Ameripol SN, isoprene, will soon be available from American sources in sufficient quantities to back the commercial production of the rubber.

Last month Shell Chemical Co. announced that work was in hand at Carrington to 'establish substantial capacity' for the manufacture of the new polydiene rubbers. This plant will probably not come on stream until 1962 or 1963.

Durham Raw Materials Ltd., sole selling agents for the Durham Chemical group, are also selling agents for certain products of Du Pont, J. M. Huber Ltd., and others.

Polymer Add Two

Polymer (UK) Ltd. have introduced two more Polysar rubbers. They are Polysar Krylene 602 (1s. 10¼d. per lb. ex store) and Polysar Kryflex 202 (2s. 1¾d. per lb. ex store).

BHC CONTRACTS AWARDED

British Hydrocarbon Chemicals Ltd. have announced the names of contractors who will construct the three new petro-chemical plants at Grangemouth (*RJIP* March 26).

Contractors for the methanol plant are Chemical Construction (GB) Ltd., and for the butadiene plant Fluor Engineering and Construction Co. Ltd. The Lummus Co. Ltd. will construct the ethylene dichloride plant. These three facilities will cost an estimated £5m., and they are expected to be completed in 1961. They will create employment for a further hundred employees at Grangemouth.

SHELL PRICE CUT

Shell Chemical Company has cut the price of propylene oxide by £20 a ton. The reduction has been made possible, Shell says, by the expansion of manufacturing facilities at Carrington.

This may eventually affect the price of some resins and plasticizers, which use propylene oxide as an intermediate. Monopropylene glycol is one of the main raw materials for the manufacture of polyester resins and other derivatives from propylene oxide include polypropylene glycols which are finding increasing application in the production of polyurethane foams.

At the same time, Shell has also reduced the price of ethylene oxide by £20 a ton in bulk and up to £35 a ton for cylinder supplies.

Mr Max Bevilacqua Bell and Mr Ho Sim Guan have been appointed directors of Rubber Estates of Malaya.

Celene Plans Propylene Oxide Plant

Plans for the construction of a new production facility for propylene oxide and derivatives were announced on April 4 by Morse G. Dial, chairman of Union Carbide Corporation. The new plant will be constructed and operated by S.p.A. Celene, a company formed in 1957 and jointly owned by Union Carbide and Societa Edison.

The plans are said to be for a plant with an initial capacity of 25,000,000lb. of propylene oxide annually. The new plant will be located at Priolo, Sicily, adjacent to Celene's other production facilities. The basic raw materials for the new expansion will be obtained from the adjoining plant of Sincat. Derivatives from propylene oxide include resins and plasticizers.

Celene's initial polythene plant is already on stream and is now being expanded to a capacity of approximately 65,000,000lb. annually. Also included in Celene's operations at Priolo are facilities under construction for the production of solvents and plasticizers, with capacity of 70,000,000lb. per year.

Another Firestone No. 1

Mr T. M. Mayberry, president, was on hand at Firestone's new Calgary factory to witness the pilot production process get under way and chalk up 'Number One' on a 7.50-14 Firestone De Luxe tubeless tyre—the first to be manufactured in Western Canada (*RJIP*, March 12). It was produced to test the installation of the first tyre building and curing machines of the most advanced type and design in North America. Full production of a full line of tyres is planned to start at this multi-million dollar factory next August.

The first tyre was presented to Calgary's Mayor, Mr H. Hays, by Mr Mayberry, in a special ceremony at the City Hall.

Goodyear Expenditure Programme

The Goodyear Tire and Rubber Company of Akron, Ohio, has authorized a $90,000,000 capital expenditure programme affecting every phase of its activities, Mr E. J. Thomas, the chairman, told the annual meeting. The new authorization brings the company's total since 1955 to $440,000,000. In 1959 Goodyear authorized expenditures of $70,000,000 and spent $55,000,000.

Mr Thomas said he is still holding to his estimates made in the annual report that both replacement and original equipment tyre business will rise this year. He said that while there had been some revision of car production schedules, production plans are still ahead of a year ago.

The expenditure programme will include both the US and foreign markets.

Polymeric Progress

RECORD ATTENDANCE AT PLASTICS INSTITUTE CONFERENCE

MORE than 500 scientists—a record—attended the conference 'Polymeric Progress' which was held at London University on March 30 and 31. 15% of the delegates represented countries from all over the world, including Russia, East Germany, Hungary, Switzerland and the United States.

The papers given included contributions from leading companies in Britain, Germany and America. Subjects discussed included developments in high-temperature resistant plastics materials for rockets and supersonic aircraft, the development of plastics materials to replace die-casting metals, and the implications of the plastics industry's growing demands on the petroleum industry for raw materials.

At the conference dinner held on March 30 the speakers included a Past-President of the Royal Society, Professor Sir Robert Robinson and Mr F. J. Erroll, M.P., Minister of State, the Board of Trade.

The conference was described as an overwhelming success and one delegate commented that an important feature of the meeting was the opportunity for scientists, many of them from research organizations and university laboratories, to mix with their technological counterparts in industry.

Papers delivered were: 'Polymer science: simplicity and sophistication,' by J. R. Whinfield (I.C.I.); 'Newer methods of polymerization,' by Professor G. Gee (Manchester University); 'A new polymerization technique with Ziegler catalysts,' by Dr G. Bier (Farbwerke Hoechst AG); 'Impact of petrochemical development on the plastics industry,' by Dr H. M. Stanley (Distillers); 'New polymers: new problems,' by Professor H. F. Mark and Professor M. Goodman (Polytechnic Institute, Brooklyn, US); 'High-temperature resistant materials,' by Dr N. J. L. Megson (Ministry of Aviation); 'Acetal polymers,' by Dr W. Henry Linton (Du Pont, US); 'Polyesters of carbonic acid,' by Dr H. Schnell (Farbenfabriken Bayer AG); and 'Polyolefins,' by H. C. Raine (I.C.I.).

Reports on two of the papers are given in this issue. Further reports will follow in other issues of *RJIP*. The lectures will be published in full in the Plastics Institute Transactions, June 1960. *See pages* 536 *and* 538.

PI Conference Dinner

THE guests of honour at the Polymeric Progress conference dinner, which was held at the Connaught Rooms on March 30, were Sir Robert Robinson, O.M., F.R.S., a past-president of the Royal Society, and F. J. Erroll, M.P., Minister of State, the Board of Trade.

Sir Robert, who proposed the toast of the Plastics Institute, said that every kind of scientific development nowadays had some connexion with plastics; in this context he mentioned radiation effects, producing cross-linking, as becoming increasingly important. Earlier, he referred to the prejudice against plastics which still existed in the public mind: this was due to certain unsuitable applications and he thought there was still much to be done in this direction. He felt that perhaps the Institute should be opened to artists as well as chemists.

Responding, Mr H. F. Wilson, president of the Plastics Institute, said that the Institute was in its 29th year and was passing through the awkward stage of adolescence—with 3,500 members it was certainly too large to be called an infant.

At its meetings the Institute had always tried to avoid specialization, but he thought that eventually there would have to be sectional meetings. On this subject a programme liaison committee had been formed with the Plastics and Polymer Group of the Society of Chemical Industry to co-ordinate meetings and conferences.

This was the first occasion, he said, on which the Institute had made an excursion into the field of pure science, and it was a great privilege to have such illustrious speakers: he wanted particularly to thank those who had come long distances.

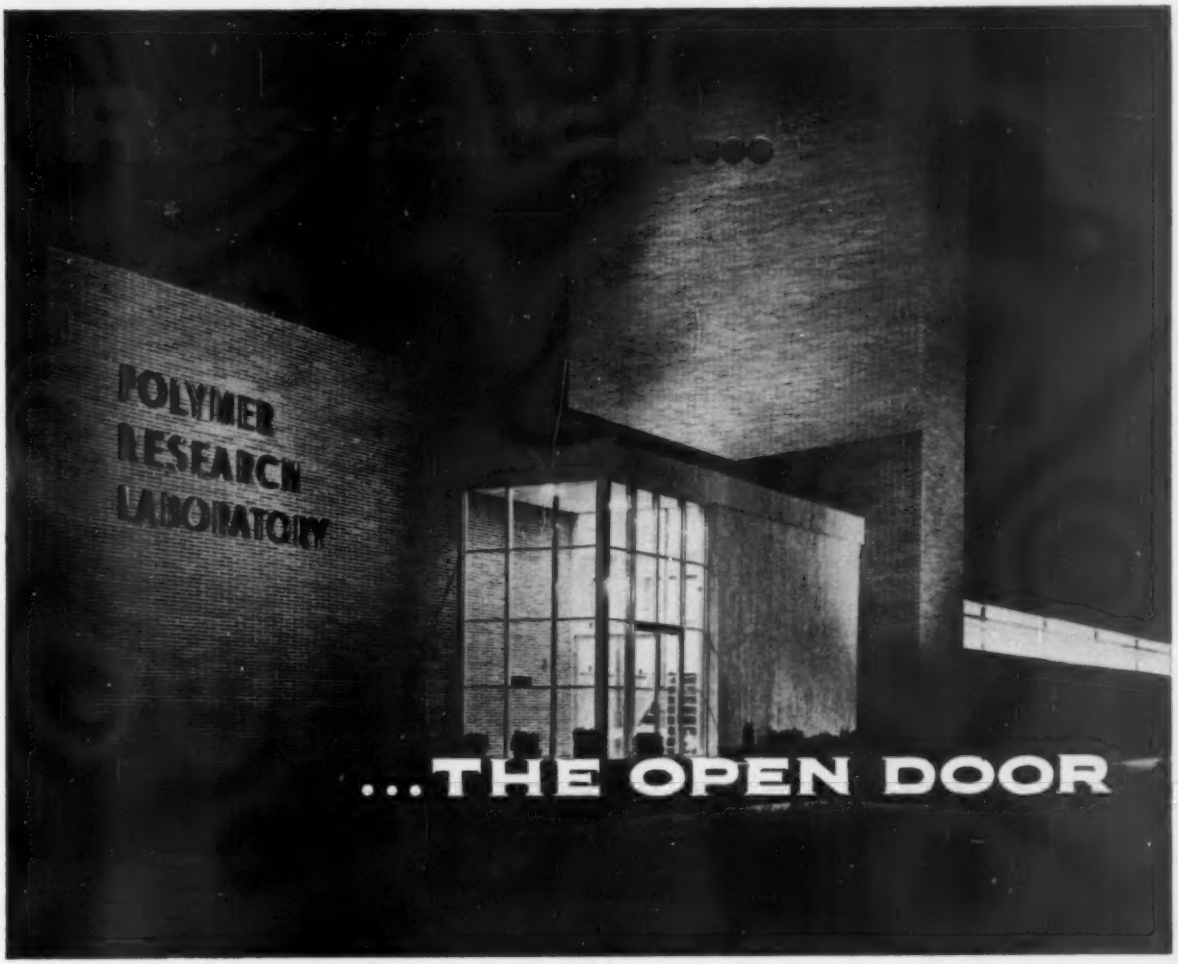
Proposing the toast of the Plastics Institute and the overseas visitors, Mr F. J. Errol said that since the conference was a scientific one, some people may have wondered why a representative of the Minister of Science was not present. But, he said, the work they did as scientists had a direct effect on the work done at the Board of Trade. The Board of Trade was the main channel of communication between the plastics industry and the Government.

Mr Errol made the point that one compromise that had to be struck at a conference of this kind was that between the free exchange of thought on the one hand, and the rights of the innovator on the other.

Dr G. Salomon, of the Central Laboratory, TNO, Delft, responded. 'In these days,' he said, 'we travel often, for business or pleasure, so we are used to being in foreign countries. But coming to this country is different, because you encourage us to take part. Thus, at this conference, there is no official interpreter

Continued on page 538

H. F. Wilson *(right)*, **president of the PI, at the Polymeric Progress Conference dinner. With him is D. S. Mahon (Bakelite Ltd.). More pictures on page 539**



The progress of the future depends on the research which is done today.

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Simplicity and Sophistication

THE introductory lecture at the conference 'Polymeric Progress,' was given by J. R. Whinfield, director of I.C.I. Fibres Division, and was called 'Polymer Science—Simplicity or Sophistication?'

Mr Whinfield recalled that Polymer Science was a relatively new subject of only about 30 years' standing, that is of about the same age as the related Petrochemicals industry. The importance of the research background could not be overestimated and had led to our understanding of the importance of crystallinity and other factors which were colouring the development of new polymers, although there was still need for more detailed understanding of the reaction mechanisms involved in many polymerizations.

He referred to the importance of condensation polymers as fibre-forming materials and recalled the early work of Lorenzo who had heated succinic acid with ethylene glycol and obtained low DP condensates without observing any fibre properties. This ground had been covered again many years later by Carothers and had led to the development of the nylons. The difference between the two investigators was the background of polymer science denied Lorenzo but appreciated in its then rudimentary form by Carothers who was thus able to appreciate the significance of his experiments. Research was easy when it worked out as you planned it but the unexpected often required complete reorientation of an approach.

In making 'Terylene,' dimethyl terephthalate had to be used in place of the free acid since the latter could not be synthesized with sufficient purity. This required an ester-interchange type of polymerization reaction instead of the more usual esterification. Again, it could not be predicted that of the three isomers only the *p*-phenylene material would yield a crystalline polymer and indeed, Bunn has produced X-ray structural evidence that all three should be able to crystallize.

Recently, Belgian workers have reported conditions under which the isophthalate may be induced to crystallize. Interfacial condensations of acid chlorides and diamines have recently shown promise as methods for preparing new polymers which cannot be produced by other methods.

Finally, the lecturer produced a diagram showing the inter-relationships between background and development work choosing as examples some of the papers which were to follow.

Newer Methods of Polymerization

PROFESSOR GEE subtitled the paper which he delivered at the Polymeric Progress Conference, 'The degree of control possible over polymer structure.' This control is usually exercised at the propagtion or growth stage of the reaction. (Fig. 1.)

The tacticity of the polymer is determined by the direction of approach of the reactive monomer unit to the end of the growing chain. The problem is essentially the same for both ionic and free radical systems. Staudinger recognized this in the 1920s but considered that an atactic polymer was more probable on statistical grounds. On consideration of steric factors, this is unlikely to be true. The probability of obtaining one syndiotactic addition is given by:

$$P\ (I\ Syndio) = \beta$$

Assuming that each propagation step occurs independently of the preceding step then, for a syndiotactic block of n units, the probability is given by:

$$P\ (n\ Syndio) = \beta^n$$

It may be shown that

$$\ln(\beta/1-\beta) = A + \triangle H/RT$$

where ΔH is the energy difference between two steps. For random addition $\beta^n = 0.5$; as the temperature is reduced, $\beta^n \rightarrow 0$ or 1. The lecturer then produced some hypothetical figure to show the effect of temperature on stereo regularity. (Table 1.)

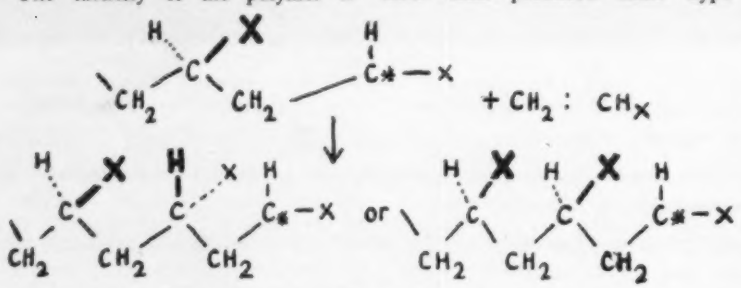

Fig. 1

TABLE 1

β	n	T°K
0.730	2.2	(333)
0.881	5.5	250
0.950	14.2	200

This has been confirmed by the preparation of syndiotactic PMMA by the Rohm and Haas Company by free radical polymerization at −70°C., *i.e.* sufficient regularity has been introduced to enable the polymer to crystallize. Normal PMMA is not completely atactic, there is a small tendency to the syndiotactic arrangement but this is too little to influence the properties of the polymer unless the n value is increased and the 'natural tendency' to produce this type of arrangement is encouraged by reducing the polymerization temperature.

The next example was the polymerization of isoprene by alkali metals or their alkyls. Here there are a number of possible structures:

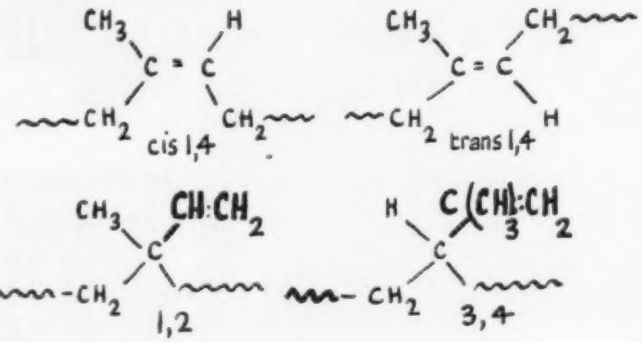

Fig. 2

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OVERSEAS AGENTS THROUGHOUT THE WORLD

P4375

Products obtained with various initiators were as in Table 2.

TABLE 2

System	% cis 1,4	% trans 1,4	% 1,2	% 3,4
F.R./emulsion	22	65	6	7
Li H/C solution	93	0	0	7
Na/K H/C „	0	50	10	40
Alfin H/C „	27	52	5	16
Li Ether „	0	49	5	46
Na Ether „	0	33	12	55

The normal anionic reaction is fairly readily explained by comparison of the stabilities and reactivities of the possible ionic intermediates. (Fig. 3) which favours the 3,4 reaction.

The Alfin catalyst is anomalous but more important from the technical viewpoint are Lithium and Lithium alkyls which favour 1,4-addition. An explanation has been put forward. (Fig. 4.)

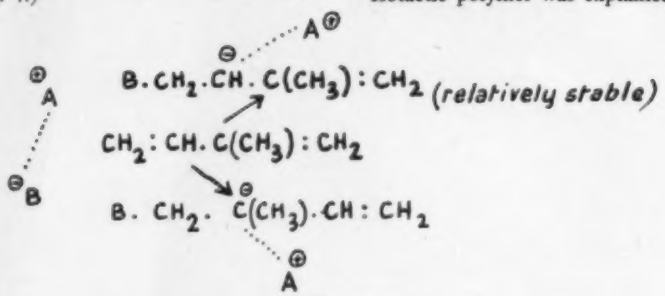

Fig. 3

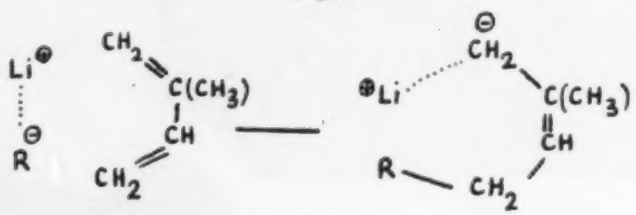

Fig. 4

It appears that the Lithium ion is just the right size to fit into a structure of this type. A similar reaction is probably possible with Na/K but would be so much slower that it is swamped by other reactions. This is confirmed by altering the polarity of the medium by addition of small proportions of THF to the hydrocarbon solvent (Table 3).

TABLE 3

%THF on Heptane	% 1,4	% 1,2	% 3,4
0	93	0	0
0.1	86	1	13
0.5	60	0	40
1.0	33	15	52

At 1% THF, the reaction reverts to the normal anionic type giving predominantly 3,4 addition.

Returning to the work on PMMA, three different types of polymer had been obtained by initiation with lithium fluorenyl at −60°C. in different media (Fig. 5).

The isotactic PMMA was of particular interest having in its composition 90 moles % DP, 20 and 10 moles % of high average DP, with a broad distribution. All chains were 'living' (in the Szwarc sense, catalyst removal being rapid). An explanation has been given (Fig. 6). This formation of cyclic living or 'sleeping' polymer would account for the low molecular weight of most of the product.

Isotactic polymer was explained by early formation of a helical curled structure which would prevent confirmation to the cyclic form and so continue in isotactic formation suggesting a second method of influencing polymer structure.

On the mechanism of the Ziegler catalysis, *e.g.*

(i) $TiCl_4$ + AlR_3 (in H/C)
ppt. containing Ti^{III}
or
(ii) $TiCl_3$ (solid) + AlR_3 (in H/C)

Professor Gee referred to valency anomalies in the accepted structures of the dimeric aluminium alkyls (Fig. 7). The bridge structures are well authenticated but not yet understood.

The reaction of an 'element of structure' in a polymerization reaction may be represented as shown (Fig. 8).

Such a reaction may cause stereo orientation but the high stereospecific control of these systems is dependent on the presence of solid surfaces and the nature of their crystal form.

Work in Professor Gee's department at Manchester has shown that polymerization of propylene oxide, a mixture of optical isomers (Fig. 9) may yet yield stereospecific polymers.

The conditions of polymerization including the effects of water and $FeCl_3$ were discussed in detail and compared with the results obtained by Price in the USA who has carried out further work on a synthesized specimen of the laevo-isomer. One conclusion of the work was that the presence of water favours heterogeneity which appears to encourage

Continued on page 551

PI CONFERENCE DINNER

Continued from page 534

but you allow us to use the English language.'

Dr Salomon went on to say that at Delft they had an old rubber tradition, so that the older generations were rather rubber minded. In fact they used to think of thermoplastics as frozen rubbers. Knowledge of rubber technology, he thought, was generally an aid to the understanding of polymers. He concluded by congratulating the president and all concerned on the achievement of the conference in marrying technology to science.

Among those present at the Polymeric Progress Conference dinner were: *(opposite page, left to right):*

1. C. L. Child (I.C.I.), L. M. Read (vice-chairman of P.I. Council), D. S. Mahon (Bakelite).

2. W. Flavell (Yarsley Lab.), E. J. Boormann (Esso), W. H. Linton (Dupont, U.S.).

3. L. A. Muirhead (Shell Chemical), M. F. Ring (Metal Box), J. R. Hickman (Metal Box).

4. Professor R. N. Haszeldine, R. E. Banks, C. L. More.

5. G. Salomon (TNO Delft), N. J. L. Megson (Ministry of Aviation).

6. F. B. Illston (Formica), W. H. Moss (The De La Rue Co.), Mrs. Moss.

7. Professor C. E. H. Bawn, G. Bier (Farbwerke Hoechst AG).

8. H. Y. Schnell (Farbenfabriken Bayer AG), J. J. P. Staudinger (Distillers).

9. E. S. Narracott (Shell Chemical), E. S. Wilson (Shell Chemical), C. A. R. Cutler (Shell Chemical), B. Van Daalen (Bataafse Internationalé Chemie Maatschappij).

10. S. B. Turner (past-chairman of council), P. S. Adamson (B.X. Plastics), P. Smith (Bakelite).

11. B. S. Dyer (I.C.I.), E. W. Rodnight (Dupont, UK).

12. G. Dring (vice-president of council), Professor Sir Robert Robinson (Shell Chemical).

13. F. J. Errol (Minister of State, Board of Trade), M. Apley (chairman, conference committee), G. Dring.

Polymeric Progress

At the Conference Dinner

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Polyurethane Foams

PART 2: BASIC EQUIPMENT FOR RIGID FOAMS

(Concluded from April 2 issue, page 504)

By J. M. BUIST (I.C.I. Ltd.)

RIGID FOAM

The first rigid polyurethane foams were made by Bayer during the war, using tolylene diisocyanate. After the war aircraft companies in both the USA and the UK were attracted by the excellent adhesion to light metals and the high strength—low weight laminates made possible by the use of a polyurethane foamed in place. This led I.C.I. to offer in 1952 a rigid foam system based on tolylene diisocyanate. No significant commercial development took place at that time because the toxicity of the tolylene diisocyanate made its use a hazard for most visualized foaming in place applications—for example, in non-ventilated spaces such as ships' holds. Another difficulty was the long mixing time and the sensitivity to processing conditions when operating this system. However, the greatest objection to these early polyurethane rigid foams was the toxity of the tolylene diisocyanate and I.C.I. developed a low toxity system based on diisocyanato diphenylmethane compositions[8]. Work carried out during the last two years has shown that systems employing this isocyanate are free from any major toxicity hazard. Substantial quantities of foam have been made during this time for the insulation of cold stores, portable refrigerated containers, the holds and domestic chambers of ships, and in factories for the preparation of laminates, without any special ventilation precautions being taken or any ill effects on the operators of the foam dispensing machines having been observed[9, 10].

Equipment

Initially a branched polyester resin was developed for use with the diisocyanato diphenylmethane composition and it was necessary to develop special mixing equipment for rigid polyurethane foams. It was felt that one of the main advantages of polyurethane rigid foams was their ability to be foamed in place on site and rigid foam machines consisting basically of a metering unit to pump the correct ratios of the two liquids to a mixing head were developed.

Typical layout of an I.C.I. rigid foam machine is shown in Figure 4. The essential features of a rigid foam machine are separate storage tanks for the resin and isocyanate, the metering unit for pumping the correct ratios of the resin and isocyanate, and a portable mixing head attached to the metering unit by any desired lengths of reinforced flexible hose. Up to 100ft. of hose have been used successfully with equipment of this type.

Storage Vessels

The size and position of the containers for the resin and isocyanate must be determined by consideration of the purposes for which the machine is to be used. Obviously, large containers can be used for static machines, but if portability is required an optimum size for the containers is approximately 15 gallons.

One difficulty in the design of truly portable equipment when using polyester resins has been their high initial viscosity and rapid increase of viscosity with decrease in temperatures. This has made necessary the fitting of heating devices in the containers for the resin. Because immersion heaters tend to cause local overheating, it is essential to have the heat distributed over as large an area as possible, and bottom heating has usually been adopted. This type of heating does, however, introduce difficulties in cleaning the storage vessels. Suitable polyether resins which have viscosities as low as 3 poises have now been developed, however, and with these resins it should not be necessary to fit heaters in the resin containers.

The containers for the isocyanate are also fitted with heaters and the equipment has been used successfully outdoors in Norway when the ambient temperature was −5°C.

Metering Units

Metering gear pumps and reciprocating plunger pumps have been used to meter resin and isocyanate.

Plunger pumps have the advantage that outputs can be varied by altering the piston stroke, but with certain types the reaction products of isocyanates interfere with the valve seatings and cause incorrect metering. Metering gear pumps are valveless but require a gearbox for speed variation when the output has to be altered. The close machine tolerances inside metering gear pumps make them vulnerable to damage from solid particles in suspension in the liquids being pumped. Filters are, therefore, advisable.

If gear pumps are used with large clearances between the gear and stator frame, the metering varies widely when the liquid viscosity changes or when the back pressure on the pumps changes. An elementary test which can be easily carried out

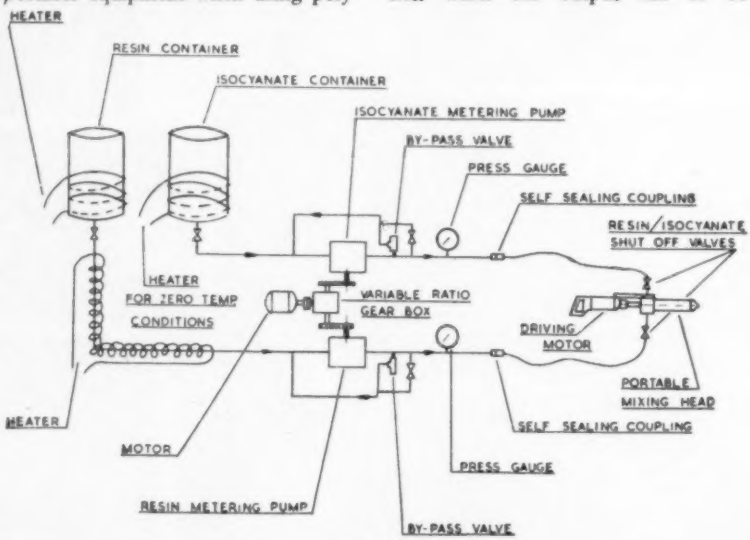
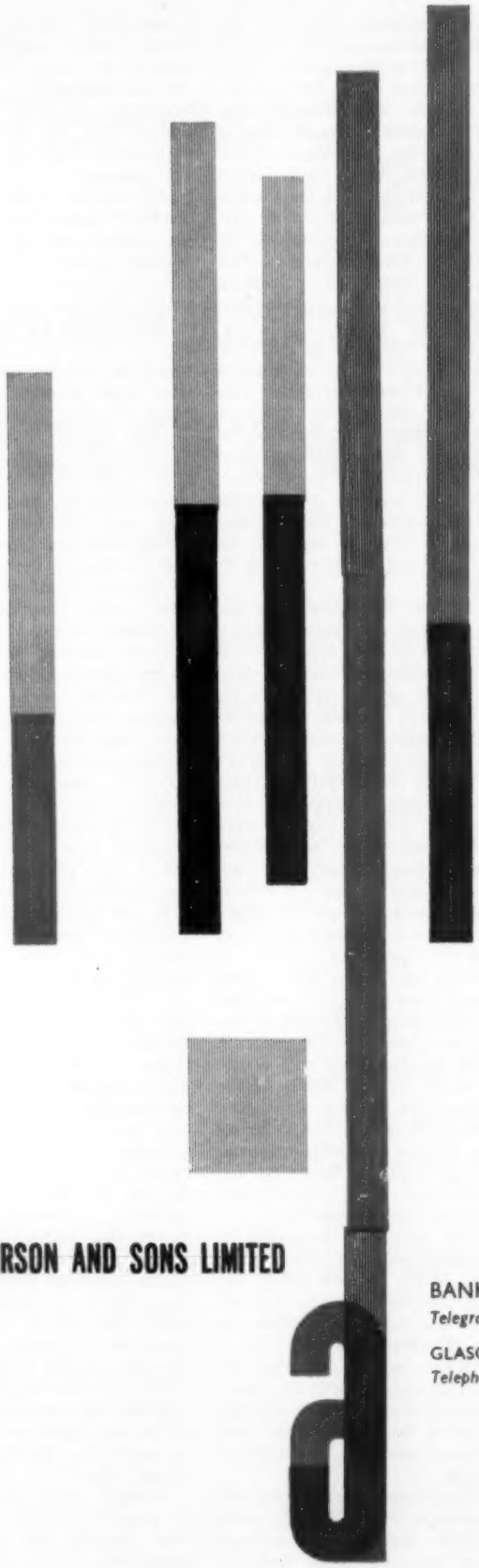


Fig. 4



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on a pump is to measure its output at a constant speed whilst the back pressure is progressively increased. The output at 100 psi should be within 1 or 2% of that at 10 psi. If a pump will not pass this test, there is little point in using it, since the back pressure under which a pump may have to operate in winter, varies considerably in the course of a few hours' running.

Pump Drive

It is possible to drive the pumps either by one motor or two. The only advantage of using two separate drives is that the speed of each pump can be varied easily by coupling it to its drive by means of a variable speed device. Two motors and two speed variators mean that the unit will be bulky and heavy. This is of little importance in a fixed machine but can be inconvenient in a transportable machine. Either electric or compressed air motors can be used, depending upon where the machines are to be used.

It is necessary to have a controlled output of material to permit accurate calculations to be made as to the amount of running time required to fill a given cavity.

Since air pressures do vary widely in practice, because of other uses, air motors can be expected to suffer speed fluctuations. Ways of mitigating this are: the use of a motor fitted with a governor which is capable of correcting for speed variation due to a lowering of supply pressure; the use of a motor rated well in excess of the horse-power required and operated from an air supply reduced to 20 to 30 psi.

The use of a governor turns the air motor into a fixed speed drive. Variations of output, if required, must then be obtained by a gearbox or variable delivery pumps. The selection of a suitable variable speed gearbox, where this is needed, should be made with care, since some of the infinitely variable gears suffer from slip and become unreliable after a few months of use.

Mixing Heads

Having metered the correct quantities of resin and isocyanate, it is necessary to mix these materials efficiently, if foam of minimum density and good texture is to be obtained.

If the mixing head is required to be portable, the power unit used in the mixing operation is inevitably limited in size and weight. Thus, it has been found by experience that electric drills of approximately ½hp are suitable, but that electric grinders which run at higher speeds and develop approximately 1¼hp are too heavy and cumbersome for *in situ* foaming. Air drills can be used instead of electric drills, but variable mixing can be experienced when using these because of fluctuations in air supply leading to variable speeds. Because of these power limitations a maximum output of rigid foam using portable heads is limited. With conventional polyesters this may be as little as 6 to 9lb. per minute but with recently developed polyethers outputs of 20lb. per minute have been easily achieved.

The mixing chamber of portable mixing heads has to be of limited size and it has been found that this can be most conveniently achieved by using a cylindrical chamber in which revolves a high speed rotor fitted with projecting pegs which intermesh with another set of pegs fitted to the interior of the cylinder. Power to the rotor is supplied by the electric or air drills referred to previously.

The resin and isocyanate enter the mixing chamber through separate entry ports. In the early type portable mixing heads shut-off valves were placed adjacent to the mixing head, so that when the operator wished to stop foam production these valves could be closed to cut off the supply of materials to the mixing chamber. The back pressure developed by this operation then actuated bypass valves on the metering pumps, so that the materials were recirculated to the storage tanks and it was, therefore, not necessary to shut down the pumps when mixing was stopped for short periods.

Experience has shown that bypass valves should not be set at too high a pressure; otherwise swelling of the flexible hoses connecting the metering unit to the mixing head will occur. Opening of the shut-off valves on the mixing head then leads to a 'surge' effect which, because of the differing viscosities of resin and polyisocyanate, can lead to incorrect metering for several minutes until equilibrium pumping pressures are reached.

When the supply of materials to the mixing chamber is stopped by the closure of the shut-off valves, the foam mix remaining in the chamber has to be removed quickly; otherwise complete blockage of the barrel occurs. This can be avoided by allowing resin only to flush the barrel after closing down the isocyanate shut-off valve, but the material containing excess resin has, of course, to run to waste.

The arrangements for cleaning the early prototype mixing heads were rather crude and led to wastage because of the necessity to flush the mixing head with resin. Self-cleaning heads which substantially reduce wastage have now been designed and are being operated successfully. Early bulk trials on foam dispensing had led to the discovery that the provision of an air bleed device in the portable mixing head led to better texture foam, and a suitable air bleed device was incorporated in the ordinary mixing head by feeding a small quantity of low pressure air into the mixing chamber near the entry ports for isocyanate and resin. A needle valve was used for controlling the amount of air, because if too much air was admitted the materials were blown through the mixer before being properly mixed.

The on/off mixing head was designed to permit the interruption and restarting of the normal continuous mixing process, so that small scale work could be tackled without a high wastage. The design is such that the mixing head is self-cleaning, to prevent foam formation in the head when supplies of resin and isocyanate are cut off.

Other mixing heads capable of on/off operation have been developed for flexible foam production; the Newton and Jennings types of head have been referred to earlier. The disadvantage of these types of head for portable operation is that four material lines go to the head, two delivering materials and two removing materials from the head. This number of lines, plus an air bleed supply line, making the head cumbersome.

In the I.C.I. mixing head (patent application pending) there is a rear port plate, *G*, with Fluon facings and entry ports for resin, isocyanate, and air. The materials can flow from these entry ports to the front face of the plate. Against the rear port plate abuts an on/off valve plate, *F*, which can be turned on its axis by an operating handle. In the on position resin, isocyanate, and air flow through the rear port plate and on/off valve plate to the mixing chamber. In the off position the supply of materials is stopped and air only enters the mixing chamber. If a suitable air valve is fitted externally to the gun, this stream of air can be increased to a sufficient volume to sweep the mixing chamber free of materials. As with the old type of portable mixing head, closing down of the materials supply to the mixer is followed by pressure build-up and subsequent operation of bypass valves to recirculate materials back to the storage vessels.

Another type of control device developed by I.C.I. (patent application pending) for use in spraying equipment promises to prove superior

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to the use of bypass valves. In this electrical contacts operated from the portable head operate a solenoid valve system to start the pumps. Release of the contacts stops the pumps and at the same time operates a valve which admits a blast of compressed air into the mixing chamber to remove residual materials.

If the mixing head is not required to be portable, a highly powered fixed mixing head is recommended. The choice of a power unit for a fixed mixing head will be dependent upon the output required, and a minimum of 2hp is recommended.

The on/off mixing head is of considerable interest in cases where known amounts of foam are required to be delivered regularly to moulds for making of laminates. In this respect there is a very close analogy between the requirements for making moulded slabs of rigid foam and the making of moulded cushions from flexible foam, and the principles involved here are of interest for production of small individual articles of flexible foam.

For example, the device can be used for the making of polyurethane flexible foams of high modulus for facia panels. The motor car industry has shown a growing realization of the need for additional protection inside cars against hard shock by including in the designs of new models facia panels which contain layers of flexible foam simply as shock absorbers. The facia panels themselves are thermoplastic polymers which can be vacuum formed into the designed shape. The foam is then made inside the hollow panel, which serves as its own mould by an *in situ* technique. The foams have hitherto been made by mixing a polyester prepolymer and an activator system. A prepolymer formation has been found necessary because the usual polyester-isocyanate-water reaction products did not yield foams with the high modulus deemed necessary for crash pad panels. Even with the prepolymer system the time available for manipulation before foaming begins is very small (of the order of 15 to 20 seconds) and this was a very real drawback, since the whole distribution of the foam forming mix had to be made into an irregularly shaped cavity during this time.

In order to overcome these defects two new materials have been devised (patent application pending): Daltocel DA, a polyester resin, and Suprasec DA, a diisocyanato diphenylmethane composition with carefully defined analytical characteristics. These materials used in the proportion of 5 to 3 have been chosen so as to give the maximum delay in the onset of foaming, more than one minute being available for manipulation after mixing, consistent with reasonable speed of cure. The cure is effected by standing at room temperature for 24 hours. The on/off mixing head described above is suitable for handling these materials.

SPRAY TECHNIQUES

Flexible Foam

By the autumn of 1957 a technique had been developed whereby polyester flexible foam was sprayed satisfactorily using a two-component system. It was found convenient to premix the polyester and activator together with acetone as a diluent to form one of the components, the other component being tolylene diisocyanate. The apparatus developed by I.C.I.[11] consisted of a metering unit used in conjunction with a commercial twin feed spray gun. Metering of both liquids was carried out with gear pumps which were driven by an air motor. The air supply to the motor was controlled by a diaphragm valve which responded to the pressures in the feed lines to the gun. When spraying was stopped, the pressures in the supply lines rose rapidly and the air to the gear pump motor was cut off. When the spray gun was operated, there was a drop in pressure in the lines and the pump motor restarted. The pumps were connected by gears, so that a fixed ratio of flow rates was maintained and a small number of different ratios could be obtained by using different sets of gears. The needle of the spray gun was hollow and the isocyanate was fed through this, with the polyester mixture being supplied through the annular space surrounding the needle, the two materials meeting immediately after leaving the gun. The quality of foam made using this gun was satisfactory for the backing of carpets and for applying foam to textiles. Nevertheless commercial exploitation of this device did not develop, mainly because of the use of acetone as a diluent, since the presence of solvents in textile factories could not be tolerated.

Rigid Foam

With the establishment of the low toxicity isocyanate for *in situ* application of rigid foams it was realized that its low toxicity made it very suitable for use in foam spraying systems, and late in 1956 a commercial two-feed spray unit was examined. Although some useful initial data were obtained, it was found that the unit was not suitable, since it had a small discontinuous output and was not sufficiently robust to meter high viscosity solventless materials. The unit was also unsatisfactory, because it was subject to blockages and did not give good mixing of the rigid foam constituents. Many types of two-feed spray guns were examined without success. The necessary development work to modify the design of metering pumps and spray guns to make them more suitable for urethane foam spraying was carried out by I.C.I.[12] and the units are now being offered commercially in the UK at prices in the region of £750.

The complete equipment consists of three separate units—the metering unit, the air pack, and the spray gun. The metering unit, which is very compact and measures only 15 x 14 x 18in., contains the two metering pumps which draw the raw materials from their containers and feed them along flexible hoses to the spray gun. The pumps are driven by a compressed air motor through a gear box by which changes in total output and ratio of one material to the other can be made.

The supply of raw materials to the spray gun is controlled by the trigger on the gun, which is connected by a low voltage electric lead to a solenoid valve in the compressed air supply line in the driving motor. When the trigger is pressed, the solenoid is

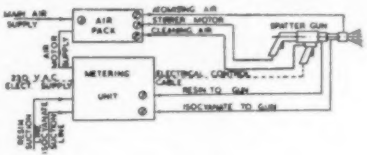

Fig. 5

opened and materials flow from the pumps to the spray gun. Conversely, when the trigger is released, the valve is closed and the supply of raw materials is stopped.

The air pack contains connexions for the various air supplies needed—for example, to the metering unit and the spray gun. The necessary pressure gauges, reducing valves, water separators, oilers, etc., are all mounted in this unit.

The spray gun is a breakaway from conventional design in that the raw materials are mechanically mixed before atomization; hence the atomizing air stream has the sole function of breaking down the mixed materials into droplets and conveying them to the surface to be sprayed. The inadequate mixing and variation in concentrations of the two components from one part of the spray pattern to another that had been found with conventional twin feed spray guns are therefore avoided. Because of its mode of operation this type of spray gun has been called a 'spatter gun.'

The stirrer which effects mixing is driven by a small compressed air motor. The stream of mixed materials can be ejected from the gun through any conventional design of spray nozzle which is suitable for high viscosity liquids. Since the mixed components react extremely rapidly to produce a foam, it is obviously essential that when the trigger is released to stop the flow of materials all reactive materials are removed from the gun very quickly. This is achieved by a stream of cleaning air, the control of which is linked to the trigger of the gun in such a way that when the trigger is released the supply of cleaning air is started and vice-versa. The cleaning air enters the gun at the back of the mixing chamber and flushes all reactive material from the chamber and the spray nozzle. Line diagrams of this equipment are shown in Figures 5 and 6. The compressed air supply required to operate this equipment is 50 to 60 cu. ft. per minute at a minimum pressure of 80 psi. With the I.C.I. spray unit a layer of foam can be applied up to ¾in. thick at the rate of 24 sq. ft. per minute, the density of the foam being in the range 3 to 4lb. per cu. ft.

Even with improvements in foam spraying equipment, the production of sprayed foams was found to be very difficult. The high viscosity of conventional polyesters made mixing and atomization difficult and the conventional amine catalyst had an unpleasant odour and did not give a sufficiently fast reaction. These difficulties were overcome by the development of an internally catalyzed polyether resin. This resin is not a prepolymer but is a simple polyether and has a viscosity of only 3 poises at ambient temperature. The low viscosity even at subzero temperatures not only allows the resin to be drawn easily from the containers in which it is delivered, thus obviating the necessity for mounted storage vessels, but also allows a greater ease of mixing with low viscosity polyisocyanates than can be obtained when using more viscous resins. The ease of mixing and ready compatibility of this resin with the diisocyanato diphenylmethane composition can be judged from the fact that the foams consist of closed cells of very small size (0.1mm. average diameter) and have a high resistance to water vapour transmission and a low thermal conductivity (K=0.21BTU/sq. ft./hour/in./°F.). This work leading to the development of new equipment and materials for the application of foams by spraying is an apt illustration of the interdependence of engineering design and chemical synthesis.

This equipment has also been used to handle successfully the high modulus polyester flexible foam referred to earlier, which was developed for crash pad applications. It has also been used to handle polyether

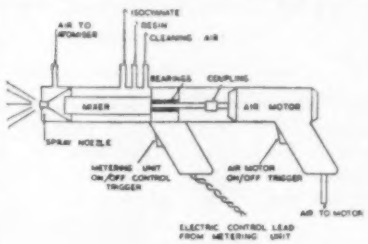

Fig. 6

and polyester prepolymers for flexible foam, although greater experience in the handling of these materials with this equipment is required. The ability to apply layers of foam by a practicable spray process has excited a good deal of attention in the UK. It has been suggested that for certain types of insulation — *e.g.*, marine insulation—the use of a spray process would obviate the necessity for the construction of costly shuttering. It has, however, been recognized that in certain of these applications reinforcement of the foam surface would be necessary. There is every indication that this will be achieved by injecting chopped glass or organic fibres into the stream of material leaving the spray gun.

Conclusion

The details and discussion in this paper emphasize the importance of engineering design in developing the urethane foam industry. The basic design problems are essentially the same whether the equipment is to be used for the manufacture of flexible or rigid foam. Much greater use can and should be made in applying the experience gained in each of these fields to the other.

Further advances both in engineering and in the chemicals available for urethane manufacture will be made in the future. In the writer's opinion it will become increasingly possible to simplify some methods of manufacture and raise outputs of others as advances are made in both the engineering and chemical fields, but it will also become more vital that developments in each field are closely integrated.

Acknowledgment

The author would like to thank his engineering colleagues, J. R. K. Moore and A. F. Knowles, and also his colleagues in the Urethane Polymers Group of I.C.I. Ltd., for the information on which this paper is based.

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DCL Management Changes

The Distillers Company Ltd. announces that Mr G. F. Ashford has been appointed deputy chairman of the Chemical Group, The Distillers Company Ltd., as from April 1 1960. Mr J. M. Rimington, managing director of the Chemical Division, is retiring on this date for reasons of health after 30 years' service, and will be succeeded by Mr J. H. Dunn. Mr J. S. Hunter will succeed Mr Dunn as assistant managing director (commercial) of the Chemical Division.

Designed to solve the problem of carrying luggage on a scooter, the 'Tura' is both a suitcase and a scooter boot. Manufactured by North Manchester Plastics Ltd. from glass/fibre-reinforced Bakelite polyester resin

VIEWS and REVIEWS

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **Dr Schidrowitz**

'Technical Papers'

AMONGST the list of technical papers in the index of the *Bulletin* of the *ASTM* of February 1960 (No. 244), are such diverse subjects as 'A Reliable Technique for Measuring Brush Wear in an Atmosphere Containing Silicone Vapour' and 'Hardness, Abrasion, and Wear Resistance Testing of Plastics.'

Then we have 'Improved NBS Abrasive Jet Method for Measuring Abrasion of Coatings.'

All of these are reminiscent of the plastics age and are as such a sign of the times.

The first is by J. S. Axelson and F. M. Precopio who is with the General Electric Co. (of US), and in 1956 he was transferred to the D.C. Motor and Generator Dept., where he is an application chemist; his associate in the present paper transferred to the same dept. in 1955, and here he is supervisor of the Chemistry and Insulation Dept.

In the following the subject of the present work is described. Because of many conflicting brush vendor claims a critical examination was made so that these differences might be understood and perhaps resolved.

The technique used here uses a large number of brushes, for better statistical interpretation, running on slip rings in an enclosed chamber where the silicone atmosphere is accurately controlled by using a reservoir of fluid of appropriate vapour pressure. Using this method, very reproducible wear data have been obtained on a given grade of brush many months after the original brushes were run.

Brushes, supposedly designed for high performance in the presence of silicones, were obtained from five vendors. According to 'our' tests three of these showed no improvement over the standard control brush, and the best performer in a silicone atmosphere failed to show the low wear rate of the control brush in a normal atmosphere.

Hardness, Abrasion, and Wear Resistance of Plastics

(Presented at the 15th Annual Technical Conference of the Society of Plastics Engineers, New York, N.Y., January 1959) by Ladislav Bloor.

The general appreciation of the contents of this paper may be gathered from the following:

'A great variety of tests for these three properties of plastics may be found in the ASTM Book of Standards. Such profusion of methods can confuse the uninitiated and even, at times, the expert. In this paper the author reviews the methods available, and discusses the applicability of the results. Ladislav Boor, Chief, Instrument Section, Technical Division, Military Clothing and Textile Supply Inspection Agency, US Army Quartermaster, Research and Development Division, Philadelphia, Pa.

Methods Discussed

Amongst the methods discussed by the author are: *Hardness* (in general), Indentation Hardness, Scratch Hardness Methods, Abrasion and Wear, and Summary. (Before entering on his present occupation, Mr Boor was with the New Jersey Zinc Co. working on quality control of nitrocellulose plastics; with the American Cyanamid Co. as physicist, testing laboratory; and with American Instrument Co., as development engineer.)

The third paper, an 'Improved NBS Abrasive Jet Method for Measuring Abrasion Resistance of Coatings,' is by Aaron G. Roberts, project leader, Organic Coatings Section, National Bureau of Standards—engaged in research and development on organic coatings since 1946. His activities in recent years have included the development of physical methods of test with emphasis on problems of abrasion resistance and adhesion.

A description is given of the many improvements in the Abrasion Jet Method since publication of the original article describing this rapid, reproducible, and versatile means for measuring the resistance of organic and other coatings. (The Abrasive Jet Method utilizes a jet of fine abrasive particles, under closely controlled conditions of flow, pressure, distance, angle, to abrade through the coating to the substrate, in a timed operation.)

The present paper, in addition to setting forth improvements in apparatus and procedures, also discusses important operational factors that should be borne in mind by those contemplating the construction and use of similar equipment.

Notes

I have received from the Esso Petroleum Co. Ltd., 50 Stratton Street, London, W.1, information concerning their recent literature: Information Sheets 13 to 17 and No. 20 about Butyl rubber. It will be seen that they have summarized the main points of this literature, which is an added advantage for the busy executive or technologist.

Technical Information Sheet No. 13 — Dynamic Test Terms

Some dynamic test terms are defined and explained.

Technical Information Sheet No. 14 — New Curing Systems

Tellurac is still recommended for fast cure rate and best resistance to reversion. Scorch time may be increased by the use of a secondary accelerator such as copper dimethyl dithiocarbamate or by substitution of stearic acid by copper stearate. The report concludes with a study of the effect of sulphur donors and low sulphur content on thermal stability. Photographs of Goodrich flexometer pellets are shown in addition to static and dynamic compression test results.

Technical Information Sheet No. 15—Butyl Tread Cap Compounds

The effects of variations in sulphur accelerators and process oil are noted as changes in stress strain and Goodrich flexometer data. Road wear figures are also shown.

Technical Information Sheet No. 16—Tread Base Compounding

A similar report to TIA-15 only concerning tread base compounds.

PHILIP SCHIDROWITZ

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MEN and MATTERS

A Review of People and Events

by George A. Greenwood

FIFTY years ago, the Damard Lacquer Co. Ltd., from which Bakelite Ltd. had its origin, started production of plastics materials at 98 Bradford Street. To commemorate the event there was a luncheon last month at the Tyseley Works of Bakelite Ltd., which must have been unique for at least one reason. At this function there were present 28 members of the staff who were originally employed by the Damard Co., and who have served the Bakelite Ltd. organization continuously since that time. In fact, their service to the plastics industry totals over 1,000 years. More than that, Mr A. Lloyd, the production director, who welcomed the guests, said that those present came from every department, so that they must have contributed something particularly significant to the development of this now vast undertaking.

Mr Lloyd, who has himself had a long innings with the company, recalled its early Bradford Street days, and said that nowhere was the striking progress made since that time better revealed than in a comparison of trading figures over the half-century. In 1910, for example, total net assets were about £2,000; in 1959 they stood at approximately £5¾ millions. Fifty years ago, nine people were on the Damard staff. Today over 3,000 were employed by Bakelite Ltd.

Early Pioneers

Mr Lloyd paid tribute to the early pioneers such as Mr H. V. Potter, the guest of honour, whose faith and determination had, he said, contributed immeasurably to the high esteem in which the company is held today.

In reply, Mr Potter, who was managing director of Damard Lacquer Co. Ltd., and a former managing director and chairman of Bakelite Ltd., joined Mr Lloyd in a tribute to the early pioneers, and drew special attention to the great debt owed by all present to the founder of the company, the late Sir James Swinburne.

Mr Potter and Mr Lloyd were presented with booklets, printed on vellum, signed by all those at the luncheon, and each member present received a commemorative Warerite table mat, especially designed in honour of the event.

Revertex Changes

When Mr T. Harcourt Powell presided at the annual meeting of Revertex Ltd. in London the other day, shareholders got from him an interesting statement which included references to changes in the personnel of the directors. It had already been announced that Mr A. F. Baillie had retired as managing director after 17 years' service, but Mr Powell was able to announce also that Mr Baillie had agreed to remain on the board in a consultative capacity. Two men who have been with the undertaking for many years, Mr H. K. Marsh and Mr C. J. Fitzgerald, have now become joint managing directors, and at the meeting Dr Ian Kemp, who joined the board in March last year, was formerly confirmed in his appointment as a director. Dr Kemp has been in the service of the company for over 20 years, first as chemist in charge of its research establishment in Malaya, and after the War as chief chemist to the company on the home staff.

The late Mr Alexander King of Hornton Grange, Edgbaston, Birmingham, formerly managing director of Albright and Wilson (Manufacturing) Ltd., of Oldbury, left a fortune of £158,179, on which duty of £91,998 has been paid.

Sir William Garrett and Others

There are a lot of interesting comings and goings both in rubber and plastics just now.

At his own request, and as from last weekend, Sir William Garrett has relinquished his executive responsibilities with Monsanto Chemicals Ltd. in order to devote more time to his other interests, but he will continue as a member of the board. Sir William, who has only just relinquished his duties as president of the British Employers Confederation, has still many other irons in the fire. He is chairman of the Association of British Chemical Manufacturers, a director of Metal Industries Ltd., and a member of the Civil Service Arbitration Tribunal. He had held the position of personnel director of Monsanto Chemicals since 1957, duties which are now being assumed by Mr N. F. Patterson, director in charge of engineering and purchasing.

A newcomer to this side of industry is Mr H. C. Drayton, who has joined the board of British Insulated Callender's Cables. Mr Drayton is primarily an industrial banker and financier, as chairman of the Colonial Securities Trust Co., the Birmingham and District Investment Trust, the Electrical and Industrial Investment Co. and a member of the boards of the Corporation of Foreign Bondholders, the Midland Bank, etc., but he is also in railways, paper manufacturing and publishing, and is, into the bargain, chairman of the British Lion Stereo Co. Altogether, he is chairman or director of more than 30 undertakings. It will be interesting to see whether he goes farther into engineering and rubber.

An official announcement tells me that, consequent upon the acquisition by Rockware Glass of a substantial holding in Blewis and Shaw (Plastics), the new board of Blewis and Shaw (Plastics) will include Mr David Crabtree, Mr Ian M. Bailey, Mr John W. J. Moir and Mr James B. Livingston.

New Polymer Position

Polymer Corporation tell me that J. F. Sayre has been appointed to the newly-created position of manager, purchasing and transportation; and this new set up means that H. H. Manktelow, manager, traffic department, and J. V. Lawlor, newly-appointed purchasing agent, will be responsible to him. Mr Sayre is a graduate of McGill University and joined Polymer in 1942 as a plant engineer. In 1951 he became assistant manager of the purchasing and stores department following experience in the sales and economics and yield department. In

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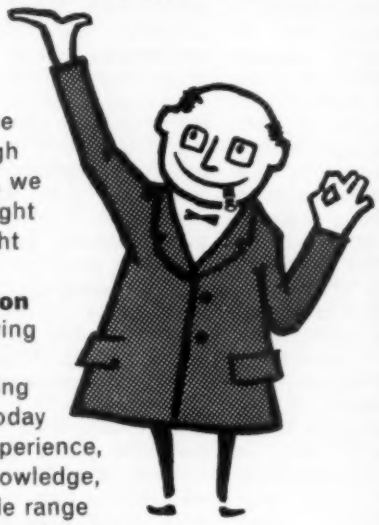

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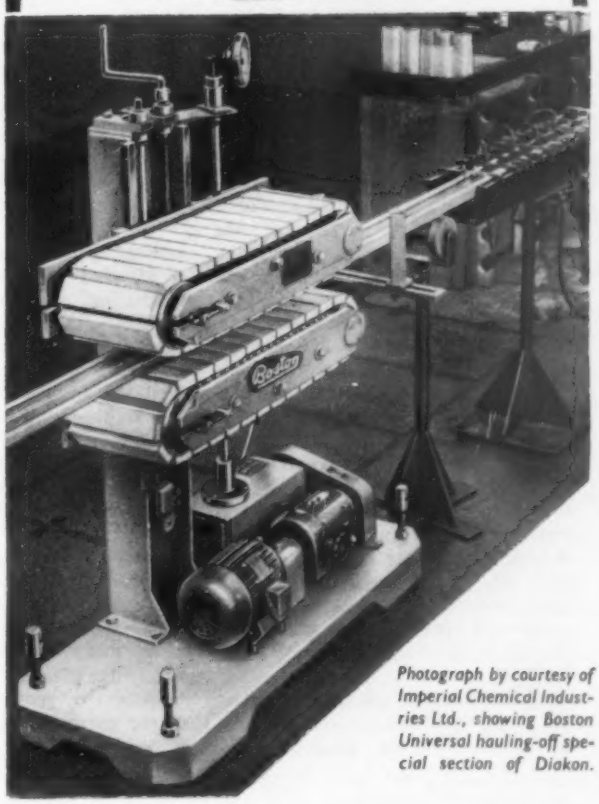

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1958 he was promoted manager of this department.

Mr Manktelow came to Polymer in 1947 as assistant traffic manager, and Mr Lawler has been with the firm since 1944.

Change in the Midlands

Shell Chemical tell me that their new plastics and rubber sales manager in the Midlands is P. J. Ward who has taken over from S. Slaney who has moved to head office, London, to take charge of the sales promotion activities of the plastics division.

In 1954 he joined Tube Investments Ltd. as a technical representative and was subsequently appointed technical sales manager of their subsidiary companies, T.I. Plastics Ltd. and Mange Plastics Ltd., being responsible for the market development of their extruded and moulded products throughout the UK. He joined Shell Chemical last year, and has taken a specialized course of training at the Royal Dutch/Shell Laboratories, Delft, Holland.

Well known in plastics circles in the area, Mr Ward has been a member of the Midland Section of the Plastics Institute since 1949 and has seen much of the development that has taken place in the Midlands plastics scene during the last twelve years.

A Happy Family

From the Northern Rubber Co. Ltd. there comes a copy of the latest issue of 'Northern News,' its magazine and house organ. Within the 22 pages, there is plenty of evidence to indicate the sort of happy family which this undertaking represents, for everybody seems to know everybody else, and nothing happens within its compass that is not recorded.

The magazine opens with an interesting review above the signature of Mr A. F. Pegler, who writes about deaths and retirements, accident prevention, changes in hours, etc. Mr Pegler has an interesting reference to the reduction of the working week to 42½ hours. 'It has been claimed by the union,' he writes, 'that this reduction from 44 hours could be achieved without any loss of production, and that greater productivity could cover the 1½ hours less working time per week. The management rearranged schedules accordingly, and it is hoped that everyone is responding to the challenge.'

Mr Pegler expresses regret at the news that Mr G. Green will not offer himself for re-election when he retires by rotation from the board of the company this spring. 'George Green,' he writes, 'completes 60 years with the Northern this year, and has become more than an institution—he is a living legend. We shall all be very sorry to see him go in May, but his diamond jubilee year is an appropriate time to finish, and we all hope he and Mrs Green will have many more happy years together.'

Incidentally, 1961 will mark the 'Northern's' 90th birthday. The directors are already preparing suitably to mark the occasion.

Enterprise

Still more companies whose activities are in one way or another concerned with rubber and plastics are moving in upon a bigger scale. In the statement issued by Mr Leslie R. Gale, chairman and managing director of Clee Glass Works Ltd., to synchronize with the annual meeting held in London this week, he announced that the board had decided that it was time to enter the plastics market, and said that the necessary preliminaries were under way. 'Fortunately,' he added, 'through our connexion both here and abroad, we shall be in a position to obtain valuable technical advice.'

All the companies either making rubber or goods from rubber and plastics seem to be doing well. To the list I gave a week or two ago, can now be added Redfern Holdings, who report a sharp recovery in profits from £16,573 to £56,748, and a dividend of 6% is recommended.

Question Corner—112

(Second Series)

437. Describe the use of polyvinyl butyral in the manufacture of safety glass.

(Answer next week)

Answer to Question Corner—111

436. Polyacrylonitrile is rather difficult to mould because it lacks flow, but by co-polymerizing with other monomers good moulding materials can be produced. The lack of flow in high nitrile polymers and co-polymers can be overcome by the use of plasticizers. Acrylic and methacrylate esters, vinyl chloride and styrene have been used to produce good mouldable co-polymers.

When acrylonitrile is co-polymerized with butadiene and blended with phenolic resins, mouldable compounds with good hardness are produced without the necessity for high pigment loading. Such compounds are more resistant to heat oxidation with better low temperature flexibility than highly loaded compounds of equal hardness. Electrical conductivity, impact strength and water resistance are all improved.

Acrylonitrile-butadiene co-polymers containing larger amounts of the former monomer than is commonly used in synthetic rubbers are very tough, leathery and oil resistant. By blending with an acrylonitrile-styrene co-polymer, suitably pigmented, a thermoplastic material can be produced which can be handled like wood: it can be sawn, drilled, and polished. Besides being decorative it has high impact strength, resists stains, grease, oil and most acids and alkalis. (USP 2,468,975; 2,374,841; IRW 1950, *122*, 184.)

Acrylonitrile - ethyl acrylate co-polymers have been suggested for filling materials for upholstery (GP 634,597), with methyl methacrylate for oil cloth, wall panels, etc. (BP 371,812), with styrene for self-sealing fuel tanks (USP 2,412,148).

(Another question next week)

'Hot runner — Saharan steeplechaser'

Newer Methods of Polymerization Continued from page 538

Fig. 5

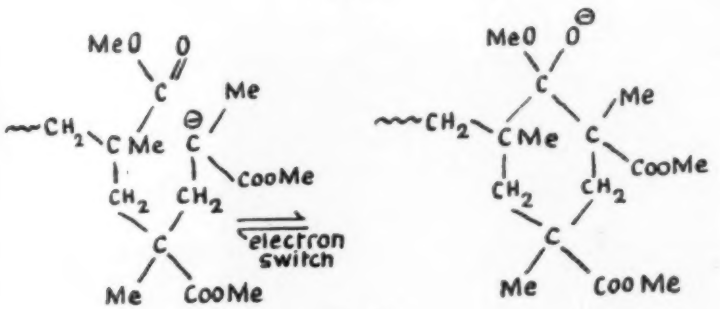

Fig. 6

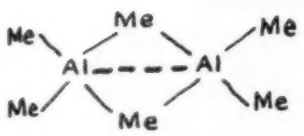

Fig. 7

the formation of crystalline structures and this provides a third method of controlling polymer formation.

to the necessity for tools to be developed which may enable us to look at the detailed distribution of crystalline and amorphous structures in one single polymer chain. He also pointed out the difficulty of deciding whether heterogeneous or homogeneous catalysis was involved in any given system, citing the case of Lithium Butyl which is a strongly associated high boiling-point liquid.

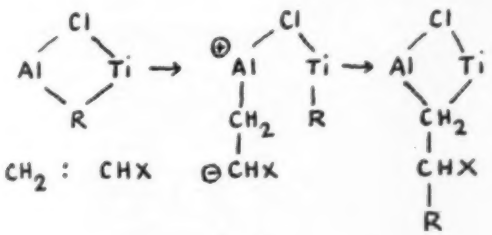

Fig. 8

A lively discussion was opened by Professor Bawn who drew attention to the question whether the associated form or the small quantity of unassociated material in equilibrium with it, was the active catalyst. Another question concerned the general potentialities of clathrate complexes in this field. Professor Gee admitted the very high specificity of these 'molecular sieves' but was dubious about their general application.

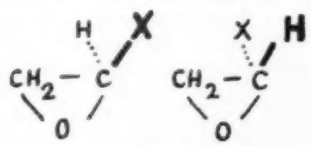

Fig. 9

Paper/Vinyl Laminates

Malcolm Campbell (Plastics) Ltd. have evolved a process whereby printed paper is laminated between sheets of BX Plastic's transparent Cobex rigid vinyl which affords complete protection not only from handling but also the most rigorous weather conditions. The technique used is high pressure laminating under heat which is said to give an extremely fine finish with rigidity, and is suited for exceptionally hard wear for items such as wiring diagrams, safety instruction notices and where weatherproof protection is essential.

Sizes up to 17½in. x 23½in. are handled and the surface can either be a high polish or matt finish, depending on the customer's needs.

Indian Shortages

The eleventh annual general meeting of the Institution of the Rubber Industry, Indian Section, was held under the chairmanship of J. Luckham, at Calcutta on February 27. Mr T. N. Singh, a member of the Planning Commission, said that there was not only a shortage of plant and machinery in India but also of trained personnel and he appealed to industrialists to provide training facilities in their factories so that young men might be better qualified to help in the country's development. Expressing the same view, Mr Luckham, managing director of the Dunlop Rubber Co. (India) Ltd., said that the rubber industry in that country constantly demanded the close attention of technologists and men trained in the fields of engineering and production to devise ways and means of coping with the advances in technology, for increasing production and utilizing the expanded range of raw material ingredients.

Mr Luckham said that with a credit provided by the US Export-Import Bank a new tyre factory would shortly be set up in Delhi: other factories were also proposed for Kerala and West Bengal. These developments would call for an additional supply of technical personnel equipped with advanced technical and scientific knowledge.

Dr D. Banerjee (Vice-Chairman and Hon. Secretary), in his annual review, said that the Indian Section, with its wide network of membership throughout India, was firmly established. Senior members held important positions in the industry and were doing their part in shaping and expanding the economy. In addition to the normal diploma courses, the section was about to start courses in Rubber Workshop Practice: a Bulletin would be issued to members periodically and steps were being taken to set up a branch in Bombay.

Too Many Companies

In a letter to the *Financial Times*, Mr Gerard Clauson said that the rubber plantation industry had developed what he called 'some very undesirable characteristics.'

There were far too many companies, he said, and far too many directorships: nearly all the directors were pluralists. He cited one company whose directors, he said, held between them at least 33 directorships.

New Two-roll Horizontal Mill

LATEST MACHINE FROM DAVID BRIDGE

THE National Joint Industrial Council's report on the safe working of horizontal two-roll mills has been taken into account by David Bridge and Co. Ltd. in the design of their new mill. Using the experience gained with the application of the latest safety principles, Bridge say they have created a new and novel design (Fig. 1).

There are no projections for the operator's feet, nor any parts covered by light gauge sheet metal covers to prevent a foothold for the operator. The safety bar has been hinged from the bottom, which avoids the encumbrances of the original counter weights system, and leaves a completely clear space for the operator. This means that there is no chance of the rubber, when it is being folded on the rolls, catching the counter weight and tripping the machine, which often occurred with the older system. The underswept design of the frame allows the operator to stand close to the safety bar without any obstruction to his feet and knees ensuring that he can stand squarely on his feet, which is the most comfortable position for operating.

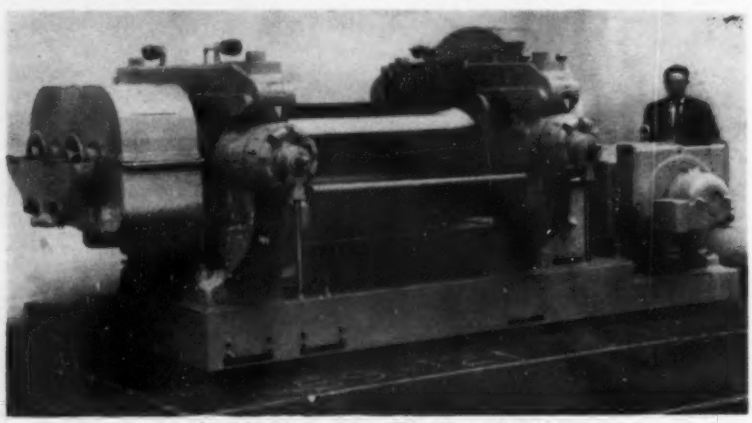

Fig. 1. The new 2-roll horizontal mill

The underswept design also allows for the base plate to be made as a straight beam. The base plate shown in Figure 1 is of fabricated steel, of monocoque construction; it is in one piece and the Vibro insulators are bolted within the bedplate; slots are provided to enable the Vibro insulators to be adjusted, giving the machine a very clean exterior appearance.

A good deal of thought has gone into the mounting of the safety switch. The mill itself has only one switch, worked by extremely robust link mechanism arranged so that it has to be reset by hand once the safety bar has been tripped. This prevents the starting of the machine until the safety trip has been reset. The electrical control gear is arranged so that the mill can run to a normal stop, but during any time the rolls are rotating, the operation of the safety trip bar will plug-brake the motor and bring the rolls to a halt.

Figure 2 shows a typical mill for the plastics industry, incorporating water-cooled bearing blocks, hinged self-adjusting guides for rapid cleaning, and high-pressure steam glands to the rolls. The hinged guides are of very robust construction and, when in the operative position, they are securely located on tapered surfaces.

The mill can also be fitted with a centre dividing guide, a stock blender, both hand and pneumatically operated scraper gear on front and rear rolls, fume extraction hood, and progressional warming devices. Rolls can be grooved for warming rubber stocks or drilled where accurate temperature control is required, as shown in Figure 3.

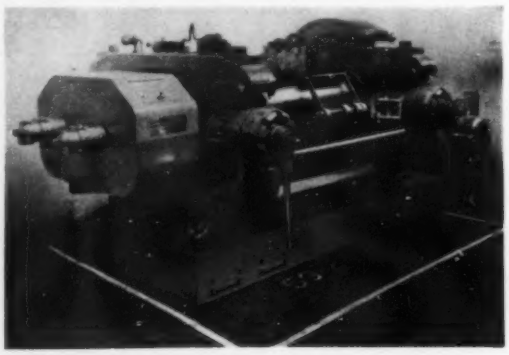

Fig. 2. Mill for plastics —incorporating water-cooled bearing blocks and high-pressure steam glands to the rolls

The guards over the main drive gears and the roller end gears are oil tight, so that the gears run in a sump of oil. The lubrication to each of the main bearings is by means of two power grease feeds, with auxiliary hand feeds for starting up or emergency lubrication. A simple labyrinth grease seal is fitted to the inside of the bearings and troughs are located to catch the surplus grease and prevent it getting on to the rolls. Alternatively, for high temperature working on plastics, the mills can be fitted with the Bridge patented flood lubrication system.

The rear bearing blocks incorporate the swivel self-aligning bearing seating (patented), which ensures correct contact between the roll journal and the bearing surface during all conditions of loading.

The standard components of this mill are also designed so that they can be mounted on conventional concrete foundations with massive cast iron bedplates. They can be arranged in batteries of one, two, three or more mills. Figure 4 shows a typical twin ıttery which is being built for ex-ort; this has a centre drive and the frames are arranged at the old standard height with a rocker gear and safety bars.

Gearbox

The gearbox can either be an oversize high efficiency worm reduc-

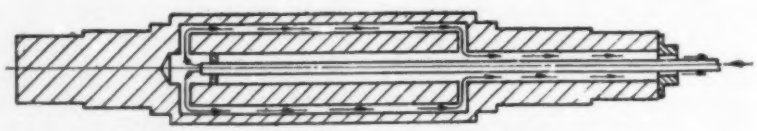

Fig. 3. Drilled roller for use if accurate temperature conditions are needed

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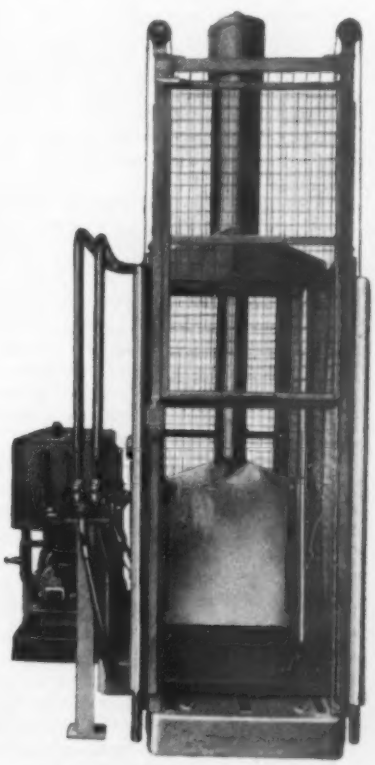

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tion gearbox, a bevel helical or a double helical. All of these are designed for continuous running and are capable of transmitting the overloads that are met with in the processing of rubber and plastics.

Fig. 4. Typical twin battery with centre drive

Installation

The mill can be installed very quickly. Recently, a mill with vibro mountings was delivered from the factory in one piece on a Saturday afternoon; it was in its position on site on Sunday afternoon; the electrical wiring was completed on the Tuesday; it was 'run in' all day Wednesday—and went into production on the Thursday. The normal working routine was hardly disturbed at all, as all the major movement of machinery was done in the weekend.

The rollers, bearing blocks, adjustment screw mechanism, safety overload devices, roller end gears, and other parts are generally interchangeable with the existing design of Bridge mills.

GSA TERMS DISCLOSED

The terms under which the General Services Administration will sell 470,000 tons of natural rubber from the USA national stockpile (*RJIP* March 19) have now been disclosed. According to the Journal of Commerce a graduated scale will set a minimum selling price of 30 cents a lb.

When the market falls below that price no stockpile sales will be made. When the market price ranges between 30 and 32 cents, the SA will sell 9,000 long tons per quarter. For a price between 32 and 24 cents the GSA will increase the quarterly sales total to 18,000 tons and the total to be sold when the price is between 34 and 36 cents will rise to 27,000 tons every three months. If the price rises above 36 cents there will be no limit on the amounts that GSA may offer on the market.

The GSA authority to sell this natural, which up till now has been temporary, was approved as permanent by the House of Representatives on March 30.

Mr Henry F. Spencer has resigned as chairman of RFD Company owing to pressure of business, but will remain on the board.

PLANT No. 58

Goodyear have now given further details of their £4½m. tyre and tube manufacturing plant which is to be built in India, 20 miles south of New Delhi.

The new plant will be located on a 50-acre site on the Agra road—which leads to the Taj Mahal—and is expected to be completed early in 1961.

Announcing plans for the plant—which, it is said, will be equipped with the most modern tyre manufacturing machinery for the production of passenger, truck and agricultural tyres and tubes — P. E. H. Leroy, vice-chairman of Goodyear, said: 'The new installation will help fulfil the need for tyres that transportation advances are creating.'

This is the third new plant outside USA to be announced by Goodyear in the past 12 months, and brings the total number of their plants up to 58. The two plants now under construction are at Amiens, France, and Alberta, Canada.

J. J. Saxby has been elected to Pargola Ltd. as managing director.

Harry Willshaw Retires

Mr Harry Willshaw, chief consulting engineer of the Dunlop Group since 1958, retired from the company on March 31. Aged 68, Mr Willshaw has been associated with nearly 200 British, American and Canadian patents relating to the rubber industry, and in 1958 was awarded the Hancock Gold Medal for outstanding service to the industry.

Born in Birmingham and educated at Saltley College School and Birmingham Technical College, Mr Willshaw joined Dunlop as an engineering draughtsman in 1913. Two years later he was appointed sectional manager in charge of solid tyre manufacture in both the UK and France. At the age of 26 he became assistant works manager at Fort Dunlop, then the company's newest factory.

H. WILLSHAW

In March 1919, Mr Willshaw went to the United States with instructions to find a suitable site for a new factory somewhere between New York and Chicago. The outcome of this was the Dunlop factory at Buffalo of which Mr Willshaw was appointed assistant factory manager. Returning to England in 1925 Mr Willshaw was again based at Fort Dunlop, this time as methods and equipment engineer.

At the heart of the blitz in 1940 Mr Willshaw became chairman of the first reconstruction panel for the Midlands, whose job was to deal with the effect of enemy action on vital factories in the Birmingham area. For his work in this field he was awarded the O.B.E. in 1942. From 1944 until 1957 Mr Willshaw was local director at Fort Dunlop. Then in 1957 he became director and general manager of Dunlop Advisory Services Ltd., the organization that has been responsible for the design of a large tyre factory in Russia. In the same year Mr Willshaw was given the additional appointment of chief consulting engineer to the Dunlop Group.

Plantation Commentary

by our Malayan Correspondent

OPPOSITION TO NEW BROKING COMPANY

CONSIDERABLE opposition has developed, including allegations that the proposal would affect the whole character of the rubber market, to the scheme for 10 Malayan rubber dealers to sponsor a new broking company (*RJIP* February 27). The main object would appear to be to obtain greater security than is possible in present conditions.

The companies concerned in the proposed moves are Anglo-American, Boustead, Harrisons and Crosfield, Paterson Simons, Hooglandt, Maclaine Watson, Sandilands Buttery, Rotterdam Trading, East Asiatic and Harper Gilfillan.

In a circular it was stated that the new broking company would be owned by principal dealers who were both Chinese and European. There was no intention to eliminate strong and worthwhile competition but the new firm would take its place alongside firms already in the market. Capitalization of $2 million was suggested by Singapore market sources and the dealers' companies, it was stated, would not have access to the day-to-day business of the broking company which would be conducted by a senior broker.

The chairman of Holiday, Cutler and Bath Co. Ltd., Mr E. G. Holiday, in a statement issued later, said that the new company would appear to offer competition against which no other broking firm could stand. His company would have no option but to close down in the event of the broking company operating and he was sure that other brokers would have to do the same sooner or later.

He alleged, 'The formation of the company would leave the producers, the importers and the manufacturers' buyers in the hands of this cartel which must eventually mean the extinction of the Singapore market and unemployment for most of the present employees. It seems to me all wrong that a number of traders owned by overseas interests, although some may be called locally registered, should seek and be able to acquire a monopoly by professional services which are now being provided almost entirely by the citizens of Singapore.'

The chairman of Lewis and Peat (Singapore) Ltd., Mr T. E. Atkinson, urged changes in the rules of the Singapore Chamber of Commerce Rubber Association. Existing conditions were not ideal and the dealers appeared to think that if they set up a firm of their own they would automatically achieve financial security.

For years the Singapore market had been plagued by large-scale defaults and as long as the market continued to operate along the present lines these losses would continue.

'Security can be obtained only by the extension of the present settlement contract rules under which dealers and brokers are required to settle differences whenever substantial fluctuations in the price of rubber occur and in the introduction of a proper clearing house system,' he said. 'A proper clearing house should be set up which would guarantee contracts and with which all dealers and brokers should be compelled to maintain deposits of a size sufficient to meet their liabilities under all outstanding contracts.'

A Single Voice

May 1 has been set as the target date for the establishment of a Rubber Association of Singapore and Malaya which will embrace all sections of the rubber trade in the Federation of Malaya and Singapore. Under the proposed rules, members of all races will be admitted and the association will be able to speak with one voice in its dealings with overseas markets and the Singapore and Malayan governments.

The three sponsoring associations are the Singapore Chamber of Commerce Rubber Association, the Rubber Trades' Association and the Federation of Rubber Trades Associations of Malaya. The new association, it is proposed, should exercise control over the ethics of the rubber market and will be responsible for running the clearing houses. The establishment of the new association will make much more likely the eventual launching of a rubber market in Kuala Lumpur, the capital of Malaya (*RJIP*, March 26).

September Sessions

More than 70 papers have been offered by research institutions and scientists for presentation at the Natural Rubber Research Conference to be held in Kuala Lumpur towards the end of September. Registration of delegates so far received includes both Government and independent rubber research units in Cambodia, Ceylon, India, Indonesia, France, Japan, Britain and the United States.

The conference is sponsored by the Rubber Research Institute of Malaya and is aimed at bringing together research workers on natural rubber from both producer and consumer countries. For most of the conference, which lasts from September 26 to October 1, there will be two sessions, one covering production problems and the other the chemistry of the product.

Closing date for papers, either in English or French, has been set at July 15. Malayan research units will be well represented with seven different units submitting papers and a great number sending representatives.

According to the preliminary list, there will be a specialist on tropical crops from the Plant Production and Protection Division of the Food and Agricultural Organization and representatives of government and university departments in Malaya, North Borneo, Britain and the United States.

Outlook Promising, But . . .

A firm demand for natural rubber seemed likely to continue throughout 1960 but it would be imprudent for producers not to try in every possible way to improve their competitive position, it is stated in the annual report of the Rubber Producers' Council of Malaya. The future outlook, the council considers, is promising with the continuing upward trend in the world usage of all rubbers over the years.

The report notes that Malaya entered 1960 with 1.6 million acres under high-yielding rubber which is 46% of the total area of rubber. It is in a favourable position to meet the challenge of a competitive market but it 'will only be in a secure position when 100% of its trees are high-yielding.'

The report says, 'The aim should not be lost sight of, irrespective of periods of prosperity such as the present which past experience has taught the industry not to count upon as being of long duration.'

Welcoming the appointment of Mr Chew Hock Leong, as the new executive chairman of the Malayan Rubber Export Registration Board, the report says that it is a matter of concern to Malayan producers to ensure that adequate and effective measures are taken to protect the good name of Malayan rubber in consumer countries. This concern is shared by the vast majority of Malayan packers and shippers whose reputations are at stake. But there are a few in the trade, usually those interested in large quick profits before closing shop, who could do great damage to Malaya's interests if not checked. For this reason the board had been brought into existence to investigate complaints from abroad with power to inflict heavy penalties on those proved guilty of deliberate malpractice in tendering rubber not in accordance with contract specifications.

Small Lots

The statistical need for the Malayan rubber industry not to relax in its replanting programme has also been emphasized by the 'Planters' Bulletin,' the magazine of the Rubber Research Institute of Malaya. It brings out a fact, not generally noted before, that the average yields from high-yielding trees planted and in commercial production are not as high as they should be.

In an editorial commenting on the detailed 1958 figures, which are now available, the Bulletin comments that the peak acreage of estate rubber was

reached in 1953 when it was 2,041,000 acres. In 1958 it was 97% of this figure. It concludes that this may be due to fragmentation under which well-run rubber estates are purchased by financiers and others for splitting into small lots for sale to smallholders at a profit.

In 1955, planting and replanting on estates was 3.3% and smallholdings an estimated 2.2%. In 1958 the figures had increased to 4% for estates and 4.7% for smallholdings, and the Bulletin concludes that if planting continues at these rates a complete replanting of rubber could occur within 25 years.

'The economic life of the tree itself can be estimated as at least 35 years so there is little doubt that replanting on estates is making ground at the expense of obsolete rubber which is not uneconomic but could with advantage be replaced with high - yielding material,' says the Bulletin.

The 1958 figures for smallholders' replanting were better than those for estates and reflected credit on those concerned with improving smallholder replanting.

The Bulletin points out that in 1958 more than half the areas under rubber in Malaya were planted with material which, given good husbandry, would give a high and economic rate of production. The yield of high-yielding material in pounds per acre per annum in 1956, 1957 and 1958 was 781, 806 and 854, and the corresponding figures for unselected seedlings were 354, 374 and 404. The increase in unselected seedlings was likely to be due to the exclusion of the poorest areas following clearing and replanting and to other factors.

The position of high-yielding rubber, says the Bulletin, was more complicated but in general the average yield of 854lb. an acre was low. Apparently only 20% of the mature acreage under high-yielding material yielded more than 1,000lb. per acre per annum and only 2% yielded more than 1,200lb. per acre per annum. These figures were capable of improvement which would no doubt become manifest in later years.

Commenting on the use of high-yielding rubber, the Bulletin points out that estates of under 500 acres were lagging in replanting while estates of 1,000 to 5,000 acres were speeding up.

Referring to claims that have been made recently that Malaya has achieved the highest natural rubber output of any country in the world, the Bulletin says: 'We think that these figures show how this has been accomplished and further why the Federation of Malaya can be expected to continue to achieve high output figures in the future. While there is some way to go before areas replanted with rubber achieve maximum production by the use of high-yielding rubber material, the changes over the last five years hold out great promise for the future.'

Processing Aid 80

A steady demand is now likely to develop for Processing Aid 80 (PA 80) says the Rubber Research Institute, announcing the successful preparation of a suitable masterbatch. It is essentially an intimate mixture of 80% vulcanized rubber and 20% unvulcanized rubber and is in close relation to the present family of superior processed rubbers.

About three tons was dispatched from here towards the end of last year to the United Kingdom, the United States, Japan, Australia and New Zealand for evaluation in consumers' laboratories, and the institute states that it is already evident that a steady demand is likely to develop.

The institute points out that SP rubbers have been mainly confined to first-quality goods for which high grade rubbers must be employed. It would be difficult to introduce SP properties into many of the lower grade rubbers and the institute had sought instead to develop an SP masterbatch which the user could incorporate with any grade or mixture of grades of rubber, natural or synthetic.

After describing the process of production on estates, the institute says that the additional equipment required by an estate already equipped to produce crepe is a ball mill, a supply of steam, a slow speed stirrer, a small laboratory to determine solids and dry rubber content, tanks for vulcanization and dilution of the vulcanized latex, drying trays to fit into conventional tunnel driers and minor modifications to baling boxes.

'It is considered that a reasonable selling price will be 10½ to 14 cents (Malayan) per lb. more than RSS 1, and it is at this price level that our first orders are being executed,' states the institute.

'It remains to be determined whether commercial production will confirm our assessment of a reasonable price.

'Production of established grades of SP rubber has now reached a level of 3,000 tons a year. We believe that the introduction of PA 80 will enable SP properties to be incorporated into a much wider range of manufactured goods and we have every confidence that the ultimate demand for SP rubber will considerably exceed the output.'

All Traction Nylon

A new replacement on and off-the-highway tyre for trucks—called the All Traction Nylon truck tyre—is announced by the Firestone Tire and Rubber Company, Akron. Firestone say that it will be low-priced, and add that it is 'the greatest nylon replacement traction truck tyre we have ever offered.'

The tyre is claimed to be ideally suited for truckers hauling building materials, ready-mix concrete, oil, lumber, farm supplies, coal and similar truck services where about 90% of hauling is on paved roads. The tread is up to 61% deeper than that of regular highway truck tyres.

45 Years with Steel

Mr C. P. Percy, after 45 years' service with J. M. Steel and Co. Ltd., Kernhouse, Kingsway London, retired from the office of managing director on March 31, but retains his seat on the board, and, for the time being, remains as chairman.

Mr A. G. Ballard and Mr H. R. Peters were appointed joint managing directors and Mr J. V. Webb was appointed secretary of the company.

Mr S. Perry, secretary of the Baxter Group, has been appointed joint managing director of Rubber Improvement.

The East in the Market

The Natural Rubber Bureau in its April 'Natural Rubber News' said that the growing importance of the Soviet Union and China in world rubber consumption has been one of the prime factors in determining natural rubber prices in recent years.

It added that Soviet and Chinese buying or lack of buying have determined market trends frequently in much greater degree than would seem likely from their actual consumption levels.

This has been true primarily because the volume of their purchases swings so widely from year to year, and there is far more uncertainty about consumption trends in Sino-Soviet countries than in the Western World. It noted that although the market frequently 'has exaggerated their intentions to purchase over a short period, probably most rubber forecasters have underestimated and continue to underestimate their effect in the long run consumption picture.'

Waste AGM

At the annual general meeting of the Waste Rubber and Plastics Merchants' Association, held on March 22, L. W. Bottomley was elected president and J. T. Simmons vice-president.

The annual report showed that the exports of waste rubber from the UK during 1959 amounted to 24,196 tons, worth £821,888. This was more than 1958, but less than the four years before that. Exports of waste plastics, on the other hand, were well up, topping the million mark, 217,458cwt.

Rubber Statistics

WORLD POSITION AT THE END OF 1959

IT is now possible to estimate the position of the leading producing and consuming countries up to the end of last year, and to compare with this their results for 1958. The following table, which is expressed in 1,000 long tons, shows the natural rubber production position during these two years side by side.

NATURAL PRODUCTION

	Jan./Dec. 1959		Jan./Dec. 1958	
Malaya:				
Estates ..	408½		391	
Smallholdings	289½		272½	
		698		663½
Indonesia:				
Estates ..	214		238½	
Smallholdings	507		429	
		721		667½
Ceylon ..		91½		100
Thailand ..		170		137½
Sarawak ..		43½		39
Other British Borneo ..		23		23
Liberia ..		42½		42½
India ..		24		24½
Vietnam ..		74½		70½
Cambodia ..		34		33
Others ..		143		156½
		2,065		1,957½

Indonesia continues to maintain her lead as the world's largest natural rubber producer, though closely followed by Malaya.

In the case of Indonesia, a large increase in smallholder production, which may well be attributable to the high price which has persisted during the year, is offset to some extent by a decline, amounting to some 10%, in estate production, probably reflecting a reduction in efficiency on those estates which formerly belonged to the Dutch. Of the remaining producing countries, Sarawak shows a 10% increase, and Thailand almost a 20% increase. In spite of claims which have appeared in some quarters regarding high yields in Vietnam and Cambodia, the increase in these two countries is only of the order of 5%. In Ceylon, there was a decline in the neighbourhood of 10%, and there was no appreciable increase in the case of either India or Liberia. The overall increase in natural rubber production during 1959 was of the order of 5%.

The following table shows the natural rubber consumption position during last year.

NATURAL CONSUMPTION

	Jan./Dec. 1959	Jan./Dec. 1958
UK	180½	175½
USA	555	484½
France	133½	137
Western Germany ..	141	129
Remainder of Europe	483	471
Others	612	583
	2,105	1,980

With all countries, except for France, increasing their consumption somewhat, to give an overall increase of a little more than 5%, the main increase is to be found in the case of the USA, which now consumes rather more than one-quarter of the total world supply. Nevertheless, as may be seen from the following table, setting out the synthetic rubber consumption position, the USA's increase in consumption in this case was nearly three times as great as for natural rubber; the USA now consumes very nearly two-thirds of the total world supply of synthetic.

SYNTHETIC CONSUMPTION

	Jan./Dec. 1959	Jan./Dec. 1958
UK	79	63
USA	1,071	880
France	66	55
Western Germany ..	69	54
Remainder of Europe	89	64½
Others	183½	131
	1,557½	1,247½

Other manufacturing countries have also been increasing their consumption. The overall increase in synthetic consumption during 1959 was approximately 25%.

Italy

Figures now made available by the Secretariat of the International Rubber Study Group show that, during 1959, Italy consumed in all 95,188 tons of rubber, of which 56,898 tons were natural, 28,620 tons synthetic and 9,670 tons reclaimed rubber.

Of the natural rubber, 34,868 tons went into tyres and tubes, compared with 18,631 tons of synthetic. Of the remaining natural rubber, 17,237 tons were used for technical and other articles and 2,986 tons for footwear. Of the remainder of the synthetic rubber, 4,520 tons were used for technical and other articles, 4,098 tons for cables, 601 tons for footwear and 770 tons for soles, heels and sheeting. Of the reclaim rubber, 4,449 tons went into tubes and tyres, 4,247 tons into technical and other articles, and 454 tons into footwear. Latex accounted for 9,830 tons of the natural rubber and 685 tons of the synthetic rubber.

BOOK REVIEW

POLYMER, THE CHEMISTRY, PHYSICS AND TECHNOLOGY OF HIGH POLYMERS. (Butterworths Scientific Publications, London. Quarterly annual subscription: UK £5. US $15.)

The appearance of a new journal is likely to dismay the scientific worker staggering under the weight of literature already produced, but the present venture is a welcome addition. Devoted to the study of high polymers, and generally in line with the Journal of Polymer Science, the first issue contains a number of interesting papers and the composition of the Editorial Board suggests that standards will be maintained at a high level. It is hoped that this new quarterly will assist in reducing the delay at present experienced by authors in obtaining publication. Perhaps, from time to time, space may be found for authoritative reviews of particular subjects as distinct from publication of original work; this would be a particularly useful addition to high polymer literature. The standard of printing is, as usual with Butterworths, very good, graphs, photographs, diagrams and formulae being reproduced with the utmost clarity and accuracy.

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

The Michelin 10.00-20 'X' Zigzag steel-cord tyre is suitable for fitment on rigid 28-ton tankers, announce the firm's Technical Division.

Mr R. J. Godber has been appointed a director of Laras (Sumatra) Rubber Estates in the place of the late Mr H. J. Tapscott.

Motor-boat or sidecar. Mounted on a quick-release chassis, this amphibious unit is fitted with BX Plastic's Cobex rigid vinyl side screens and hood. On water it can carry two passengers and reach a speed of 11 knots

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

High Impact Polyvinyl-Aromatic Compound

No. 824,368. Styrene Products Ltd. Inventors: E. Seijo and A. N. Roper. Application, November 28 1956. Filed, September 18 1957. Published, November 25 1959.

A synthetic elastomer, preferably SBR, is blended with a polyvinyl-aromatic compound, preferably styrene, on a two-roll mill or in an internal mixer at an elevated temperature. There is then added to the blend a small proportion of (1) a monofunctional monomer and/or a polyfunctional monomer and (2) a free-radical catalyst. Styrene is a preferred monofunctional monomer and divinyl benzene is a preferred polyfunctional monomer. After addition of the monomer and catalyst, mixing of the blend is continued. The synthetic elastomer is present in the final mixture in a proportion of 5-30%.

The products have high impact strength and mouldings formed from them have smooth surfaces. Vulcanizing ingredients are not required as the monomer and catalyst effect cross-linking of the elastomer in the blend.

Flexible Barges

No. 824,984. Dracone Developments Ltd. Inventors: W. R. Hawthorne and J. C. S. Shaw. Application, March 13 1957. Filed, April 1 1958. Published, December 9 1959.

The stability of a flexible barge is improved by changing the pressure of the fluid contained in the barge or in some of its sub-divisions or compartments, whereby tension in the fabric wall of the barge and the period of sloshing of the liquid contents can be varied. Pressure can be prevented from increasing above a certain maximum by providing the barge with one or more relief valves, while control of the pressure of the fluid in the barge or in its compartments may be achieved by controlling admission of water to one or more compartments of the barge. The water compartments may be separated from the remainder of the volume of the barge by fabric diaphragms arranged as flexible cones or the water compartment may be in the form of one or more long tubes of flexible fabric loosely connected to the barge.

Corrosion-Resistant Coatings

No. 825,457. St. Helen's Cable and Rubber Co. Ltd. Inventor: C. H. J. Avons. Application, March 1 1956. Filed, February 28 1957. Published, December 16 1959.

A composite protective coating for metal or concrete surfaces comprises three layers applied successively to the surface, as follows: (1) A main layer of a mixture of hydraulic cement and a latex or emulsion of a film-forming natural or synthetic thermoplastic organic material. (2) An anchor coat of a film - forming thermoplastic material which is the same as, or compatible with, that used in the main layer. (3) A layer of PVC plasticized with an organic polysulphide rubber. The preferred film-forming material is polyvinyl acetate because of its good resistance to solvents, while for the hydraulic cement, aluminous cement is generally preferred to Portland cement because of the greater resistance of aluminous cement to corrosive solvents. The composite coating is resistant to water and to petroleum fuels and is particularly useful for application to the inner surfaces of steel fuel storage tanks. It may be used also for repairing corroded steel storage tanks or for application to the inside of concrete storage tanks.

Shorter Abstracts

Polythene. 824,003. Metal Hydrides Inc. Filed, January 10 1957.—A catalyst for the polymerization of ethylene is prepared by heating a tetrahalide of titanium, zirconium, hafnium or thorium with an alkali metal or an alkyl metal hydride at a temperature between 100°C. and 250°C.

Polythene. 824,289. Petrochemicals Ltd. Filed, September 27 1957.—A refined mineral oil is mixed in a proportion of 0.5 to 20% with polythene or polypropylene produced by low-pressure polymerization. The oil improves the flow characteristics of the polymer.

Adhesive Metallized Plastic Sheet. 824,438. T. J. Smith and Nephew Ltd. Filed, July 8 1958.—A foil of plastic material metallized on one or both faces has a layer of pressure-sensitive adhesive on a metallized face, adherence of the adhesive to the metallized face being improved by a tie-coat of casein, borax and latex.

Polythene Compositions. 824,480. Union Carbide Corporation. Filed, November 19 1957.—A polypropylene glycol monoalkyl ether having an average molecular weight of 750 to 3,000 is incorporated in polythene in a proportion of 0.005 to 0.5%. This addition reduces the coefficient of friction of the polythene and is therefore of special value for polythene film to be used in automatic processing equipment.

Hydrocarbon Compositions. 824,521. 'Shell' Research Ltd. Filed, December 20 1957.—The resistance of liquid and solid hydrocarbons to oxidation and discolouration is improved by the addition of a phenothiazine derivative which has a benzyl or substituted benzyl group in the 10-position. The treatment is particularly applicable to low-pressure polythene and polypropylene.

COMPANIES in the NEWS

Peco

Profits, before tax, of the Projectile and Engineering Company are almost doubled at £265,330 for 1959, and a final dividend of 11% makes 15%, against a single payment of 6% previously.

After tax of £127,336 (£50,742), the net balance is up from £84,446 to £137,994. General reserve is allocated £70,000 (nil) and pension fund again receives £2,000. The carry-forward is £76,587 (£71,230).

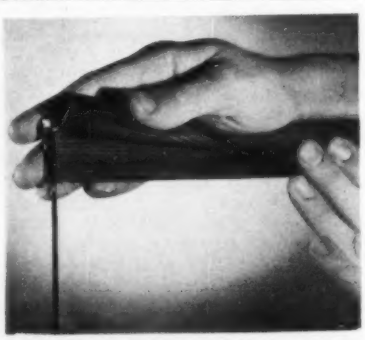
Bakelite

The turnover of Bakelite in 1959 was appreciably higher than in any previous year, reports Mr Stanley Adams, chairman, in his annual review.

Demands for established products were maintained at a high level, and newer thermoplastic materials showed a marked increase. The position in the polythene field was further improved, and the group is well placed to participate in the growing market for this material in packaging, cable insulation, moulded housewares, and other applications, the chairman adds.

He says some setback was experienced in sales of polyester resins, due to domestic and world-wide shortage of one of the basic chemicals used in their production. However, already there are signs of improvement in the group's position.

Group gross profit for 1959 was also a record. As reported earlier (*RJIP*, March 19) with the higher 17½% (15%) dividend, the net profit rose from £239,330 to £613,842.



Climatite' synthetic rubber window seal gasketing, a new product from Firestone Tire and Rubber Company, Akron, is being used in buildings which feature large expanses of glass. Fitted around window panes, 'Climatite' is said to act as an anchor and cushion to protect the window from wind shock and vibration. It is claimed to resist weathering and serve as an insulator

Rubber and Plastics Stock Market

A REVIEW OF PRICES AND TRENDS

PRIDE of place in this issue on stock market affairs must go to the mighty IMPERIAL CHEMICAL INDUSTRIES company, dubbed by the financial wizards of the City, the cornerstone of British industry. The stock market had been waiting eagerly for the groups' results and final dividend for weeks. When they finally arrived there was hardly anyone who could have said that they were disappointed.

Just take a glance at these fabulous figures: Group sales up by 10%—from £463m. to £509m. Exports jumped 18½%—from £73.8m. to £87.5m., and the group income before tax no less than 64%—from £44.5m. to £73.1m.

The dividend was made up to 11¼% or 2s. 3d. a share against the 1958 total of 8%. This compared with recent forecasts of between the actual figure paid and 12½%. With turnover still rising the outlook for the combine remains good. Will it be needing to raise more money from the market soon? The full accounts will no doubt throw some light on the subject of capital expenditure but with profits, etc., of the order now reported, it is difficult to believe that there is any immediate danger. Equity earnings are now 24.6% as compared with 13.7%. Depreciation last year went up to £33.1m. (£29.6m.) and with the simultaneous jump in profitability 'cash flow' has spurted from £49.9m. to 70.3m. At their present price the yield on the shares is £3 12s. for every £100 invested. Although this is a little below the dividend yields in the *Financial Times* index, it is not below the kind of return warranted by the leading UK equity in the stock exchange.

Is there going to be increases in profits tax or purchase tax? Will there be a touch of the brakes on 'never-never' business? These are the questions that have kept the amber lights flicking in Throgmorton Street during the past few weeks. Monday's budget will have brought the answers. Whatever the Chancellor of the Exchequer decided investors must remember that there is a solid and prosperous economy beneath us with every prospect of longer-term growth. It is probably right to assume that top-class shares may not be in for such a big rise as in the previous twelve months. All things being equal, however, they should continue to follow a gentle upward course.

Meantime, of course, there is still plenty of company news to keep interest alive. Mr S. Barratt, head of ALBRIGHT AND WILSON, says that he does not expect a 'large increase' in the volume of group sales in the current year. Competition, 'particularly overseas,' is expected to intensify in 1960. The group has, through improved efficiency and economies, been placing itself in a stronger competitive position and 'much effort continues to be devoted to this end.' It also seems probable that profit margins will tend to narrow as a result of increases in some

Continued on page 560

Share Price Movements

Par Value	Company	1958-59 High	Low	Mar. 26	Latest
£1	A.E. Ind. Ord.	67/6	53/9	56/3	54/7½
5/-	Albright & W. Ord.	31/-	13/4½	30/9	29/6
£1	„ „ „ 5% Pref.	18/9	15/4½	16/6	16/3
5/-	Anchor Chemical Ord.	27/6	10/3	25/6	25/-
5/-	Andersons Rub. Ord.	4/6	1/1½	3/3	3/1½
£1	Angus Geo. Ord.	47/3	25/3	43/-	47/3
5/-	Ault & Wiborg Ord.	24/-	11/6	21/9	23/3
£1	Avon India Rubber Ord.	47/6	35/6	36/3	37/6
£1	„ „ „ 6% Pref.	18/9	16/6	18/9	18/9
10/-	Bakelite Ord.	47/3	22/-	43/-	46/9
£1	„ 6% Pref.	19/6	17/6	18/-	18/-
£1	Baker Perkins Ord.	53/9	41/3	51/-	51/3
4/-	Bank Bdg. Rubber Ord.	3/7½	1/6	3/6	3/6
5/-	Boake (A) Roberts Ord.	30/3	12/3	30/3	30/3
£1	„ „ „ 5% Pref.	16/9	13/9	16/3	16/3
4/-	Brammer H. Ord.	18/3	9/6	17/-	18/-
10/-	Bridge, David Ord.	58/-	24/3	55/-	56/-
5/-	Bright, John Ord.	18/9	9/6	16/6	17/3
2/-	Brit. Ind. Plas. Ord.	13/6	6/9	8/-*	8/3
2/-	„ 10% (tax free) Pref.	4/9	3/-	4/9	4/9
£1	British Xylonite Ord.	90/6	46/-	88/-	90/6
£1	„ „ 5% Pref.	16/9	15/-	16/9	16/9
£1	BICC Ord.	61/-	44/6	56/-	58/6
5/-	BTR Ind. Ord.	13/3	8/1	12/-	13/3
£1	„ „ 7½% Pref.	24/3	20/9	23/9	23/9
£1	Courtaulds Ord.	67/9	20/-	66/4½	66/3
£1	„ 5% 1st Pref.	18/9	15/7	17/3	17/3
£1	„ 6% 2nd Pref.	22/6	19/-	20/6	20/6
4/-	Cow, P. B. Ord.	8/3	6/6	8/3	7/10½
£1	„ „ 5% Pref.	15/6	12/6	15/6	15/-
1/-	Dannimac Mfg. Ord.	11/6	5/2	11/6	11/6
10/-	De La Rue Ord.	73/9	42/9	69/6	66/6
£1	„ „ „ 3½% Pref.	12/9	10/6	11/6	11/6
10/-	Distillers Co. Ord.	39/6	23/6	36/9	37/3
£1	„ „ 6% Pref.	23/-	19/6	21/3	21/3
£100	„ 5% Conv. Loan	£97	£92	£95	£97
£100	„ 5½% Unsec. Loan	£98½	£90	£92½	£92½
10/-	Dunlop Rubber Ord.	29/9	17/-	24/9	23/9
£1	„ „ 5½% Pref.	20/3	16/3	18/-	17/9
£100	„ 3½% 1st Debs.	£78	£71½	£76	£76
£100	„ 4½% 2nd Debs.	£88	£80½	£86	£86
£1	Eng. Elect. Ord.	61/-	37/9	44/6	42/3
4/-	Ebonite Cont. Ord.	15/3	11/-	12/6	14/3
£1	English China Clays Ord.	94/3	47/-	91/10½	76/3xc
£1	Goodyear Tyre 4% Pref.	13/-	11/9	12/-	12/-
5/-	Greeff Chem. Ord.	33/3	15/-	33/3	32/1½
10/-	Greeff Chem. 5½% Pref.	8/9	7/6	8/9	8/9
5/-	Hackbridge Hldg.	19/9	14/-	15/7½	15/7½
4/-	Greengate & Irwell Ord.	7/-	4/-	5/9	5/9
£1	Harrisons & Crosfield Dd.	64/-	30/9	54/4½	55/9
1/-	Hunt & Moscrop Ord.	2/6	1/1½	2/4½	2/3
£1	Imp. Chem. Ord.	63/1½	32/9	62/9	61/3
£1	„ „ 5% Pref.	19/-	15/6	17/3	17/6
£100	„ 4½% Unsec. Loan	£90½	£84	£88	£88
£100	„ 5½% Conv. Loan	£196½	£178	£192	£195
1/-	Kleemann (O. & M.) Ord.	10/3	4/3	9/4½	9/9
£1	„ „ 6½% Pref.	19/-	14/-	18/9	18/9
2/-	Lacrinoid Prod. Ord.	4/3	1/5½	3/7½	4/-
5/-	Laporte Ind. Ord.	34/9	19/3	33/-	34/3
£1	„ „ 7½% Pref.	24/3	21/10½	23/9	23/9
£1	Leyland & Birm. Rubber Ord.	59/-	39/9	50/-	50/-
£1	„ „ „ 6% Pref.	19/-	17/-	18/9	18/9
2/-	London Rubber	14/9	6/3	12/3	12/3
£1	„ 6% Red. Cum. Pref.	20/-	16/3	18/9	18/9
£1	McKechnie Bros. Ord.	71/3	39/3	67/6	67/6
£1	„ „ 'A' Ord.	67/6	38/9	65/-	65/-
£1	„ „ 6% Cum. Pref.	17/-	16/-	17/-	17/-
5/-	Monsanto Chem. Ord.	27/9	14/9	25/6	25/3
£1	„ „ 3½% Pref.	13/6	12/-	13/-	13/3
£100	„ „ 6% Debs.	£104½	£101	£103	£104
£1	North British Rubber	21/3	15/7½	20/4½	20/6
5/-	Plastic Enginrs. Ord.	28/-	10/3	28/-	28/-
5/-	Redfern Holdings Ord.	7/-	2/6	4/3	5/3
2/-	RFD Ltd. Ord.	6/9	4/-	5/6	5/6
£1	„ „ 5½% Pref.	16/6	12/-	13/9	13/9
2/-	Rubber Imp. Ord.	10/9	4/-	6/-	6/-
2/-	„ „ 'A' Ord.	10/3	3/6	5/-	5/6
£1	„ „ 5% 1st Pref.	13/3	10/-	12/7½	12/6
5/-	Rubber Reg. Ord.	19/-	10/-	18/9	18/3
4/-	Shaw Francis Ord.	26/3	13/6	24/10½	26/3
2/-	Silentbloc Ord.	13/-	7/6	11/-	12/6
5/-	Storey Bros.	36/-	13/1	36/-	35/9
2/-	Sussex Rubber Ord.	2/1	1/3	1/7½	1/9
5/-	Sutcliffe Speak Ord.	15/6	6/3	15/6	16/-
£1	Turner & Newall Ord.	113/9	68/6	111/6	105/6
£1	„ „ „ 7% Pref.	25/6	22/6	23/3	23/3
5/-	Universal Asbestos Ord.	43/-	14/3	38/9	39/6
5/-	Viscose Dev. Ord.	15/-	9/-	15/-	15/-
5/-	Warne William (Holdgs.) Ord.	19/3	10/9	17/6	18/3

Rubber Markets

LONDON

Prices in the London rubber market fell back following the news of the terms of the US stockpile release. The terms provide for unlimited sales at present high prices, and this took the market by surprise. Prices in the East particularly fell back and this brought prices in other centres down. There was some recovery later but even so falls range to ¼d. per lb. on the week with the Spot a ¼d. lower at 34⅜d. per lb.

Latest prices are as follows:

No. 1 RSS Spot: 34¼d.-34⅜d.

Settlement House:
May 34⅜d.-34½d.
June 34⅜d.-34⅝d.
July/September 33¾d.-33⅞d.
October/December 33¼d.-33⅜d.
January/March 32⅜d.-32¾d.
April/June 32⅛d.-32¼d.

No. 1 RSS cif basis ports:
April 34¾d.-35d.
May 34⅝d.-34⅞d.

Godown:
April 119¼ Straits cents nominal.

LATEX

Centrifuged latex per gallon in drums, seller, May 20s. 5d., cif European ports, Spot, d.w. 19s. 11d. Bulk, nominal value. Creamed, seller, May 19s. 11d. Normal, seller, May 15s. 8d.

AMSTERDAM

The Amsterdam rubber market ruled as under on April 4:

	Guilders per kilo	
No. 1 RMA	April 4	Previous
April	3.33	3.33
May	3.33	3.33
June	3.33	3.33
April/June	3.33	3.33
July	3.23	3.23
August	3.23	3.23

Sales: 15. Tendency: Steady.

DJAKARTA

There were only a few buyers on April 4. The market closed steady and quiet.

	Rupiahs per kilo	
	April 4	Previous
Spot No. 1 Priok ..	39.75b	39.75p
Spot No. 2 Priok ..	38.75b	38.75p
Spot No. 3 Priok ..	37.75b	37.75p
No. 1 fine pale crepe, spot	37.50b	37.50p

Tone: Steady.

SINGAPORE

Some short-covering and trade buying absorbed most offerings and business was restricted without fluctuations after the market had opened steady on April 4. Factories were quiet and lower sheets were neglected. The announcement that the Malayan Federation's February output was 54,522 tons had no effect on the market. Traders said this figure was high for a February since in addition to it being a short month wintering of the trees was starting.

	Straits cents per lb., fob Malayan ports to open ports	
	April 4	Previous Close
No. 1 RSS, Apr.	119½–119¾	118½–118¾
May	119⅜–119½	118 –118¼
No. 2 RSS, Apr.	118 –118¾	116½–117¼
No. 3 RSS, Apr.	115½–116¼	114½–114¾
No. 4 RSS, Apr.	113½–114½	112½–113
No. 5 RSS, Apr.	110¾–111¾	109½–110½
No. 1 Spot ..	119½–119¾	118½–118¾
No. 3 blanket, thick remilled crepe, April ..	113 –115	112 –114
No. 1 fine pale crepe, April ..	130 –131	129 –130
2X thin brown crepe, April ..	112¾–113½	112 –112½

Tone: Quiet.

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums fob at 226.80d per gallon.

BANGKOK

No. 1 RSS

The price of No. 1 RSS at Bangkok on April 4 was 37.25 (37.25) US cents per lb.

NEW YORK

The New York rubber market ruled as under on April 4:

DEALERS' PRICES

	US cents per lb., ex-dock	
	April 4	Previous
No. 1 RSS, April ..	39⅝b–40a	40¼a
May ..	39⅝t	40a
No. 2 RSS, April ..	39⅜n	40⅜n
May ..	39⅜n	39⅞n
No. 3 RSS, April ..	39⅜n	40a
May ..	39⅜n	39⅜n
No. 1 RSS, Spot ..	40n	40⅛n
No. 3 amber blanket crepe, June ..	39⅛n	39⅛n
No. 1 latex thin crepe, April	44⅛n	45n
No. 1 latex thick crepe, April ..	43⅛n	43⅞n

FUTURES—REX CONTRACT

	April 4	Prev. Close
May ..	39.65t	40.00t
July ..	39.20b–39.25a	39.40b–39.50a
Sept. ..	38.65b–38.75a	38.90b–39.00a
Nov. ..	38.10b–38.40a	38.40b–38.55a
Jan. ..	37.50b–37.65a	37.50t
March ..	37.00b–37.25a	36.60b–36.90a
May ..	36.35b–36.60a	36.00b–36.30a

Sales: 74. Tone: Irregular.

Rubber futures were easier on April 4 on scattered commission house selling in moderate trading. Physical rubber was softer and quiet. Later in the day futures were irregular. The far distant months were steadier on covering. The nearbys continued easy.

CEYLON

No. 1 RSS

The price of No. 1 RSS spot at Colombo on April 4 was 138¾ Ceylon cents per lb.

STOCK MARKET

Continued from page 559

costs which are not likely to be sufficiently offset by lower prices for raw materials and services and will not be absorbed in higher selling prices.

Forecasts are also complicated by the fact that this year's results will be affected by the BOAKE ROBERTS takeover. 'The general indication provided by our budgets for the year, however, is that the value of sales and profits will not differ significantly from the comparable figures for 1959,' concludes the chairman.

The chairman of O. AND M. KLEEMANN reports in his annual review that the immediate future appears to be one of 'further increased activity.' Turnover is at present 30% higher than in the previous period for last year. But he sounds a note of caution. Competition is getting 'more aggressive' and in consequence a reduction in profit margins is expected. 'I am, however, confident that your company is able to meet the challenge successfully and given a continuance of present trading conditions, results for this year should show further progress.'

GEORGE ANGUS have been able to report a good recovery in profits. Its trading surplus has risen from £406,000 to £766,000 and after tax, etc., the net balance has more than doubled at £372,000 (£162,000). The dividend lifted 5% to 15%.

From the board of P. B. Cow came news that the company was having talks about the sale of a subsidiary, which was not named (*RJIP* April 2). If the sale goes through it will further delay the publication of the 1959 prelims. It is hoped to maintain the dividend of last year's rate of 12%.

Lord Dunbee, chairman of DUNBEE LTD., has disclosed that he has purchased the share capital of COMBEX LTD. and its subsidiary, PLASTICAST DEVELOPMENTS LTD. Purchase price was not given but it is believed to have been a considerable sum in cash. DUNBEE was founded in 1946 and it is the intention of the directors to float the shares of the group on the London stock market sometime next year.

Canadian Asbestos

Shipments of asbestos from Canadian mines in February rose to 67,630 tons from 60,084 in the corresponding month last year, bringing January-February shipments to 133,152 tons as compared with 114,787 in the like 1959 period.

Mr F. E. Edmunds, a director of Ward and Goldstone (Plastics), has been appointed a director of the parent company, Ward and Goldstone.

G. W. Hodds of Bakelite has been co-opted, on to the newly-elected British Plastics Federation council.

Industry INTELLIGENCE

Technical Data

Compatibility of Hypalon with Paint Resins and Oils

Hypalon 20 and Hypalon 30 can be used to impart flexibility and resistance to impact to paints containing normally brittle resins. Conversely, where greater film hardness and freedom from tack are required, it may be desirable to add small amounts of harder resins to Hypalon paints.

Details of the compatibility or otherwise of Hypalon 20 and Hypalon 30 with paint resins and oils, in different proportions, are given in Du Pont Elastomer Chemicals Department Paint Bulletin PB-8, by E. P. Lieberman, available in the UK from the Du Pont Co. (UK) Ltd., 76 Jermyn Street, London, S.W.1. Some 80 resins and six oils are included in the bulletin, the resins being classified into the following types: Alkyd, acrylic, cellulosic, epoxy, epoxy resin esters, maleic, nitrogenous, phenolic, vinyl and miscellaneous.

Chemical Resistance of Butyl and Nitrile Rubbers at High Temperatures

The chemical resistance ratings of Polysar Butyl 301 and hard Polysar Krynac 803 compounds to 25 chemicals at temperatures up to 300°F. are presented in Polysar Technical Report No. 9:1C, by W. J. Abrams, distributed in the UK by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Three Polysar Krynac 803 compounds were used in this work, all containing 40 phr of sulphur as well as MT black and barytes as fillers. Two of the compounds contained also resins, namely (a) 50 phr of a phenolic resin and (b) 75 phr of PVC. The Polysar Butyl 301 compound contained 50 phr of FEF black. Of the 25 chemicals against the effects of which the rubbers were tested, about half are widely used acids, while the remainder include oils, sodium hydroxide, chlorine gas, formaldehyde, phthalic anhydride and silver nitrate.

Applications for Polysar Butyl Rubber

The use of Polysar Butyl rubber for electrical insulation, open-cell sponge and roof flashing material is described in three recent Polysar Technical Reports available from Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

Insulation Compound. Polysar Technical Report No. 8:11B.—A formulation is given for a compound based on Polysar Butyl 100 and suitable as a starting point in the development of compounds to meet certain United States and Canadian specifications for cable insulation. The compound is cured with a mixture of red lead, Dibenzo GMF and sulphur dispersed in a plasticizer. Data are given for the extrusion properties of the compound and for the physical properties of the vulcanizate before and after ageing.

Open-cell Sponge. Polysar Technical Report No. 8:11C.—The open-cell sponge forming the subject of this report is based on Polysar Butyl 400. It is a firm type requiring a high load for a given degree of compression. A formulation is given together with the compression-deflection properties of the vulcanized sponge. This type of sponge is recommended for use as a sealing strip between cement blocks and for hatch and manhole covers; as vibration-damping material under light machinery in contact with heat, oils and acids; as protective padding in motor vehicles and for similar applications.

Roof Flashings. Polysar Technical Report No. 8:12A.—A Polysar Butyl 301 compound is described which has all the desirable properties of a high-quality roof flashing material. It is stated to be weather-proof, rust-proof, durable and relatively low in price. It remains flexible and elastic even at very low temperatures. A compound formulation is given together with test results for physical properties and ozone resistance of the vulcanized material.

Machines, Materials and Equipment

Temperature Indicator

The latest instrument to come from Fielden Electronics Ltd. is a precision self-balancing electronic temperature indicator designed to operate with resistance bulbs but, say the manufacturers, the use of transistors, and modern production methods, enable the instrument to be offered at a price comparable with filled systems or galvanometer equipment.

The indicator is presented in a sealed case similar in size and appearance to a mercury-in-steel indicator or to a circular scale electrical meter. Resistance bulbs are used as the temperature sensitive elements and with the inexpensive cable specified, these can be any distance from zero to 300ft. away from the instrument without affecting the calibration or accuracy. This is said to have been made possible by a newly developed measuring circuit. No trouble is experienced due to mains frequency pick-up on the leads to the resistance bulb since the circuit is operated at approximately 2,000 cps.

Motive power is provided by a dc electric motor which has sufficient torque to ensure that the smallest temperature changes are faithfully followed. The instrument has a calibration accuracy of 0.5% of range and reproducibility is better than 0.25%. This makes it suitable for those industries where high accuracy, long term stability and trouble free service are prime requirements but, in view of the low cost and simple installation, it offers a modern replacement for filled systems and galvanometer type indicators.

ELU Edge Trimmer

A slitting device manufactured by Trend Industrial Equipment Ltd., 77 Dudden Hill Lane, London, N.W.10, consists of a 22,000 rpm 700-watt motor embodied in an adjustable frame capable of pre-setting the depth and height of cut required for slitting, whilst a patent rotary guide above the blade follows the contours of the article.

The machine, it is said, will also slit Formica, Warerite, Perspex and PVC sheet, and other cutters are available to make recesses in hardwood and non-ferrous metals. Where coloured Formica strips have to be bonded on to the edges of blockboard, two slitting blades (suitably spaced) will slit both top and bottom edges of the Formica at one time, and this operation can be carried out at a speed of 4-5ft. per minute. The tool can also be powered by 1,200-watt and 2,000-watt motors, which can be quickly removed and inserted into other routing attachments for dovetailing, stair-stringing, etc. These same motors can be fixed into an overhead stand for routing to template or for conversion into a spindle moulder. Prices range from £40 to £60, overhead stands being extra.

New Publications

Heat Sealing Polythene

A two-page technical data sheet that lists the problems, causes and corrective measures in heat sealing polythene film comes from US Industrial Chemicals Co., 99 Park Avenue, New York. Main difficulties, the data indicates, are often caused by improper use or design of heat sealing equipment. These problems might be non-uniform seals, weak seals, or film adhesion to the sealing jaw. The adoption of the corrective measures outlined in the data sheet are claimed to improve a heat sealing process and aid in dispelling the misconception that polythene is difficult to heat seal.

The data sheet is a supplement to the USI booklet 'Heat Seal Characteristics of Polyethylene Films and Coated Substrates.'

Future Events

INSTITUTION OF THE RUBBER INDUSTRY

London Section.—Wednesday April 13 at the Criterion, London, W.1. Annual general meeting.

Southern Section.—Wednesday April 13 at the Polygon Hotel, Southampton, at 7 p.m. Annual general meeting.

West of England Section.—Wednesday April 13 at the George Hotel, Trowbridge, at 7.30 p.m. Annual general meeting followed by 'Get Out and Dig.' Speaker: R. MacLellan (G. MacLellan and Co.).

PLASTICS INSTITUTE

South Wales and Monmouth Section.—Wednesday April 13 at the Angel Hotel, Cardiff, at 6.30 p.m. 'PVC-Coated Metals' by F. H. Smith (John Summers and Sons Ltd.) and W. E. Martin (BX Plastics Ltd.).

ASTM STANDARDS

The 1959 Supplements to the 1958 Book of ASTM Standards have been completed. Each part-supplement—there are ten—brings up-to-date the corresponding part of the 1958 Book of Standards by including new standards and revisions adopted in 1959.

Part 9. Plastics, Electrical Insulation, Rubber, Carbon Black — 546 pages. Includes 74 standards for plastics, moulding compounds, and shapes; tests for mechanical, thermal, optical, and permanence properties of plastics, as well as effects of radiation. Also included are electrical insulating materials, such as shellac and varnish, ceramic products, mica products, rubber tapes, etc. There are standards for rubber elastomers, latex, adhesives, sponge, hard rubber, and coated fabrics, tape, hose, gaskets, automotive and aeronautical products.

The 1959 Supplements, in heavy paper covers, can be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., USA, at $4.00 per part, or from *RJIP* Book Department 35s. including postage.

Latest Wills

Mr William John Gardiner, of 4 Meadow Road, Alkrington, Middleton, near Manchester, assistant manager of Durie and Miller Ltd., Broadway Works, Haslingden, died on October 23 last, intestate, leaving £4,318 gross, £2,608 net value.

Mr Harry George Pacey Mapley, of 11 Beaufort Gardens, Ilford, Essex, assistant London Manager of the Northern Rubber Co. Ltd., Retford, who died on December 28 last, intestate, left £2,905 gross, £2,830 net value.

Mr Stanley George Waring Hastilow, M.B.E., of 52 Broad Walk, South Woodford, Essex, founder and managing director of Leyton Tyre and Rubber Co., who died on November 29 last, left £66,229 gross, £63,193 net value. (Duty paid £21,831).

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

KLEEFLEX (794,460) All goods included in Class 1. O. and M. Kleeman Ltd., West Halkin House, West Halkin Street, Belgrave Square, London, S.W.1. (Class 1; February 16 1960).

CLOCEL (796,116) Plastics in the form of powders, pastes, liquids, emulsions, dispersions and graulates, all for industrial purposes. The Baxenden Chemical Co. Ltd., Clifton House, 83-117 Euston Road, London, N.W.1. (Class 1; February 16 1960).

POLYNOVA (795,351) Coating compositions and lacquers, all in the nature of paint, and all made from synthetic resins. British Cellulose Lacquers Ltd., 94 Old Broad Street, London, E.C.2. (Class 1; February 16 1960).

PERLON (786,386) Parts and fittings included in Class 12 for land vehicles, for aircraft and for watercraft; and tyres for land vehicles, for aircraft and for amphibious vehicles. Perlon-Warenzeichenverband Eingetragener Verein, Leibigstrasse 51, Frankfurt/Main, Germany. Address for service is c/o Carpmaels and Ransford, 24 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 12; February 16 1960).

SELECTOPAK (B791,949) Bags included in Class 16 adapted for use in displaying merchandise. I. B. Kleinert Rubber Co., 91 New Bond Street, London, W.1. (Class 16; February 16 1960).

TESLAR (B792,130) Wrappings and packaging materials included in Class 16 made of films or sheets of polymers of vinyl fluoride plastics. E. I. Due Pont De Nemours and Co., 1007 Market Street, Wilmington, USA. Address for service is c/o Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. (Class 16; February 16 1960).

BICC

(786,641) Electric insulating materials and articles included in Class 17 made therefrom. British Insulated Callender's Cables Ltd., Norfolk House, Norfolk Street, London, W.C.2. (Class 17; February 16 1960).

CLOCEL (796,117) Plastics included in Class 17 in the form of sheets, blocks, rods and tubes; imitation rubber and articles included in Class 17 made therefrom; and insulating materials. The Baxenden Chemical Co. Ltd., Clifton House, 83-117 Euston Road, London, N.W.1. (Class 17; February 16 1960).

IMPEX (796,552) Plastics in the form of sheets, bands, strips, films, plates, slabs, blocks, bars, rods, tubes or cylinders and included in Class 17. British Celanese Ltd., Celanese House, 22 and 23 Hanover Square, London, W.1. (Class 17; February 16 1960).

SURCOFLEX (788,983) Material in the form of strips and tubes, all made wholly or principally of plastics and included in Class 17. Surco (Plastics) Ltd., 168 Regent Street, Beeston, Nottingham. (Class 17; February 16 1960).

ORLON CANTRECE (788,664) Fibres and filaments being raw or partly prepared fibrous materials for use in the textile industry. E. I. Du Pont De Nemours and Co., 1007 Market Street, Wilmington, USA. Address for service is c/o Marks and Clerk, 57 to 58 Lincoln's Inn Fields, London, W.C.2. (Class 22; February 16 1960).

PLASTOLENE (796,097) All goods included in Class 24. Storey Brothers Co. Ltd., White Cross Mills, White Cross Street, Lancaster. (Class 24; February 16 1960).

FABRILACE (789,283) Narrow fabrics made of plastics in imitation of lace, and articles included in Class 26 made therefrom. Commercial Plastics Ltd., Willington Quay, Wallsend-on-Tyne, Northumberland. (Class 26; February 16 1960).

Bri

(793,114) Materials for packing (jointing) and insulating; and hose pipes (non-metallic). (793,108) Machine couplings and belting included in Class 7, none being made of metal. (793,112) Pneumatic tyres and inner tubes therefor; and solid tyres, not made of metal. British Nylon Spinners Ltd., Pontypool, Monmouthshire. (Classes 17, 7, 12; February 16 1960).

PATENT LIST

Printed copies of the Specifications in the following list, published by permission of the Controller of H.M. Stationery Office, can be obtained from the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d., including postage, but about six weeks after the date of this publication will usually elapse before they come available. Orders with remittance may be sent in advance to the Patent Office, and will be fulfilled immediately the Specifications are published.

COMPLETE SPECIFICATIONS ACCEPTED

Open to public inspection on March 9 1960

Courtaulds Ltd. Production of regenerated cellulose filaments. 829,869.

Dunlop Rubber Co. Ltd. Pneumatic tyres. 830,133.

Dunlop Rubber Co. Ltd. Pneumatic tyres. 830,138.

Dunlop Rubber Co. Ltd. Method and apparatus for moulding rubber articles such as tyres. 830,213.

American Viscose Corporation. Casting machine for production of regenerated cellulose films. 829,825.

K. Elbel. Process for the continuous production of hardenable synthetic resin condensation products. 829,953.

British Insulated Callenders Cables Ltd. Sealing ends for coaxial cables. 829,780.

A. G. Farbenfabriken Bayer and Freudenberg Komm.-Ges. Auf Aktien C. Process for the production of coated, impregnated or bonded fibrous sheet material. 830,088.

B. F. Goodrich Co. Apparatus and process for making cellular rubber. 829,912.

British Insulated Callender's Cables Ltd. Section insulators for use in overhead conductors of electric traction systems. 829,914.

Courtaulds Ltd. Polymerization of vinyl compounds. 830,011.

Imperial Chemical Industries Ltd. Production of polymeric polymethylene terephthalates. 829,748.

B. F. Goodrich Co. Rigid vinyl halide polymer compositions. 830,226.

California Research Corporation. Production of thioamides and nitriles. 829,920.

A. E. Womersley and H. Kellett. Devices for feeding sheets to calender and like machines. 829,928.

N. J. Goode. Ice lollies in plastic bags to be sold as pre-packs. 829,804.

Universal Conveyor Co. Ltd. Endless belt conveyor. 829,807.

Esco (Rubber) Ltd. and W. Shupak. Container closure devices. 830,051.

Submarine Cables Ltd. Multiple strand electrical conductors. 830,182.

A. G. Farbenfabriken Bayer. Dehydrogenation of gaseous hydrocarbons. 829,760.

Goodyear Tire and Rubber Co. Method and apparatus for filling tyres with liquid. 829,726.

Goodyear Tire and Rubber Co. Automatic adjustment device for brakes. 829,890.

E. Netzsch. Extrusion presses and the like. 829,848.

E. I. Du Pont De Nemours and Co. Preparation of nitro derivatives. 829,853.

P. Beiersdorf and Co. A.G. Preparation of polyureas. 830,102.

N.V. Rubatex. Production of sheets of rubber or like materials. 830,104.

Columbian Carbon Co. Rubber compounding. 829,850.

Stauffer Chemical Co. Vacuum casting. 830,122.

E. I. Du Pont De Nemours and Co. Dyeing of polyester films. 830,064.

NEW COMPANIES

Winslee Floorings Ltd. (651,266).—March 3. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in and layers of tiles of all kinds, whether of linoleum, wood, plastic or other material, etc. The directors are: Lionel Lee and Mrs. Winifred Lee, both of 9 Thurlow Gardens, Hainault. Regd. office: 180 Bethnal Green, E.2.

Electro-Techno-Dynamics Ltd. (651,298). March 3. Capital: £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in engineering, plastic, scientific, optical, electrical and electronic products of all kinds, etc. The first directors are to be appointed by the subscribers. Regd. office: 101 Leadenhall Street, E.C.3.

Arbarite Company (U.K.) Ltd. (651,661). March 7. Capital: £25,000 in £5 shares. To carry on the business of manufacturers and producers of and dealers in all kinds of resins (whether natural or artificial), plastics and plastic laminates and compositions, panels, wallboards, etc. The first directors are to be appointed by the subscribers. Solicitors: Freshfields, 31/45, Gresham Street, E.C.2.

Parkside Accessories (Whitworth) Ltd. (651,539).—March 4. Capital: £100 in £1 shares. To carry on the business of manufacturers of and dealers in plastic, plastic mouldings, etc. The directors are: Fred Lord, 565 Market Street Whitworth, near Rochdale; James Crook, 304 Moorland View, Shawforth, near Rochdale. Regd. office: 671 Market Street, Whitworth, near Rochdale.

Mayfair Plastics Ltd. (652,100).—March 15. Capital: £1,000 in £1 shares. The directors are: Mark A. Pascall, 54 Ormsby Lodge, W.4; Fredwin H. Harvey, 65 Ditton Road, Surbiton, Surrey; Alan D. J. Chater, and Albert J. Wheeler. Regd. office: 3 Shepherd Market, W.1.

R·J·I·P· CLASSIFIED ADVERTISEMENTS

Classified Advertisements may be displayed under each heading at £3 per inch, single column. Write or phone for details.

APPOINTMENTS VACANT

6d. a word, Minimum 10/-. Box 2/-.

MANAGER for moulding department in Hertfordshire, Experienced and used to full responsibility for labour control and maximum production. Excellent prospects for keen energetic applicant.—Apply Box 194. (194)

MEDIUM-SIZED progressive rubber factory in the London area have a vacancy for a fully experienced rubber mill-room foreman. Applicants must be experienced in modern mill-room techniques, able to organize production on a 24-hour basis and control production staff. This is a senior staff appointment with a progressive salary and scope for advancement. Pension scheme.—Give full details of age, experience and present salary to Box 178. (178)

MEDIUM-SIZED progressive rubber factory in the London area have a vacancy for a fully experienced rubber moulding departmental foreman. Applicants must be experienced in mass-production techniques, able to organize production lines on a 24-hour basis and control labour. This is a senior staff appointment with a progressive salary and scope for advancement. Pension scheme.—Give full details of age, experience and present salary to Box 179. (179)

PRODUCTION development trainee required by Adhesive Tapes Limited, manufacturers of "Sellotape" brand pressure sensitive products, to join existing team. Needs interest in science and industry backed by some qualifications such as a degree or H.N.C. Work involves the launching of new products and liaison between development department and sales. Also customer contact to assist with technical problems and provide assistance to sales force. Personality and initiative important and must be prepared to learn. Age preferred under 30.—Apply in writing giving full particulars and quote T/S to Personnel Manager, Adhesive Tapes Limited, Boreham Wood, Herts. (190)

RUBBER technologist/chemist required for small modern rubber factory manufacturing moulded and hand built mechanical components. To be responsible for the routine testing and formulation in a newly built laboratory. L.I.R.I. standard, aged 20-25 years. Opportunity for further study provided.—Reply giving full details of age, education and experience together with salary required to the Technical Manager, Sutcliffe Moulded Rubber Company Limited, Ossett, Yorkshire. (192)

RUBBER technologist. Two men required for compound and process development work in the laboratory of a South-West London rubber manufacturers. Experienced, or recently qualified men to at least L.I.R.I. standard, are invited to apply giving full personal details. Salary will be commensurate with qualifications and experience. Superannuation facilities exist.—Write Messrs. P. B. Cow and Co. Ltd., Factory Square, Streatham Common, S.W.16. (193)

TECHNOLOGIST of D.P.I. standard required for technical service work on PVC compounds and pastes. This is an interesting post for a man of about 25 from which further progress would be readily possible. Familiarity with the use of PVC in paste moulding/coating or injection moulding and extrusion is necessary. A pension and life assurance scheme operates in the company, to which applicants should write, giving relevant details.—RJ/VS, Vinatex Ltd., Devonshire Road, Carshalton, Surrey. (175)

APPOINTMENTS VACANT

PA

PERSONNEL ADMINISTRATION LIMITED
MANAGEMENT CONSULTANTS

Our Appointments Division has been asked to advise on the following post:

PROCESS ENGINEER Rubber Manufacturers

for an old-established and flourishing company in the London area manufacturing a variety of rubber and plastic products: the Company, which employs over 1,000, is well equipped with modern plant. He will be responsible to the Technical Manager for investigating and improving existing manufacturing processes and for devising new processes. He will also be called upon to advise on the production aspects of customers' requirements. A starting salary of up to £1,500 is offered; there is a contributory pension scheme and help will be given with removal expenses and accommodation if required. This is an excellent opportunity for a qualified rubber technologist in his late 20's, who has an engineering bent, to grow in a congenial and still expanding organisation. (Ref. 3386/RJ.)

The identity of candidates will not be revealed to our clients without their prior permission.

For the convenience of clients and candidates we have Regional Offices in ***Glasgow, Manchester, Bristol*** *and* ***Birmingham*** *but, in the first instance, applicants should forward brief details, quoting the reference number, to:—*

PERSONNEL ADMINISTRATION LIMITED
APPOINTMENTS DIVISION
2 ALBERT GATE, LONDON, S.W.1 185

APPOINTMENTS WANTED

6d. a word, Minimum 10/-. Box 2/-.

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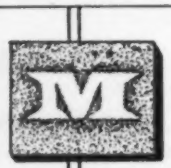

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